DRAFT CODE OF PRACTICE FOR THE FULL UTILIZATION OF SHARKS

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National Marine Fisheries Service
2570 Dole Street
Honolulu, Hawaii

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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PREPARATION OF THIS CIRCULAR

This Draft Code of Practice was compiled by Leonard G. Limpus for the Fishery Industries Division of the FAO Department of Fisheries. Its preparation was recommended by the 19th Session of the FAO/WHO Codex Alimentarius Committee on Fish and Fishery Products. It will be reviewed by the 20th Session of the Committee scheduled to be held in Bergen, Norway, in June 1992.

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ABSTRACT

Shark fisheries can make a valuable contribution to the economies of many small-scale fishing communities. In addition to being a good source of nutritious meat many other parts of the carcass can be commercialized. The Code reviews handling and processing methods for the meat in fresh, frozen, salted, dried and smoked forms, and included the principal requirements for fishing vessels and processing plants. It also covers the removal and processing of fins for the valuable oriental market and the skinning and preparation of hide for eather production. The processing of shark liver oil, as a source of vitamin A or a lubricating oil, and the preparation of jaws and teeth as decorative items, are not covered.

The provisions laid down in the Code should be considered as guidelines for the best technological and hygenic practices and should be adapted to local circumstance.

It should be remembered that because sharks grow and reproduce slowly the resource is fragile and can easily be over-fished. In the interests of sustainability shark fisheries should be closely monitored to ensure that they are not over-exploited.

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The FAO Fisheries Circular is a vehicle for distribution of short or ephemeral notes, lists, etc., including provisional versions of documents to be issued later in other series.

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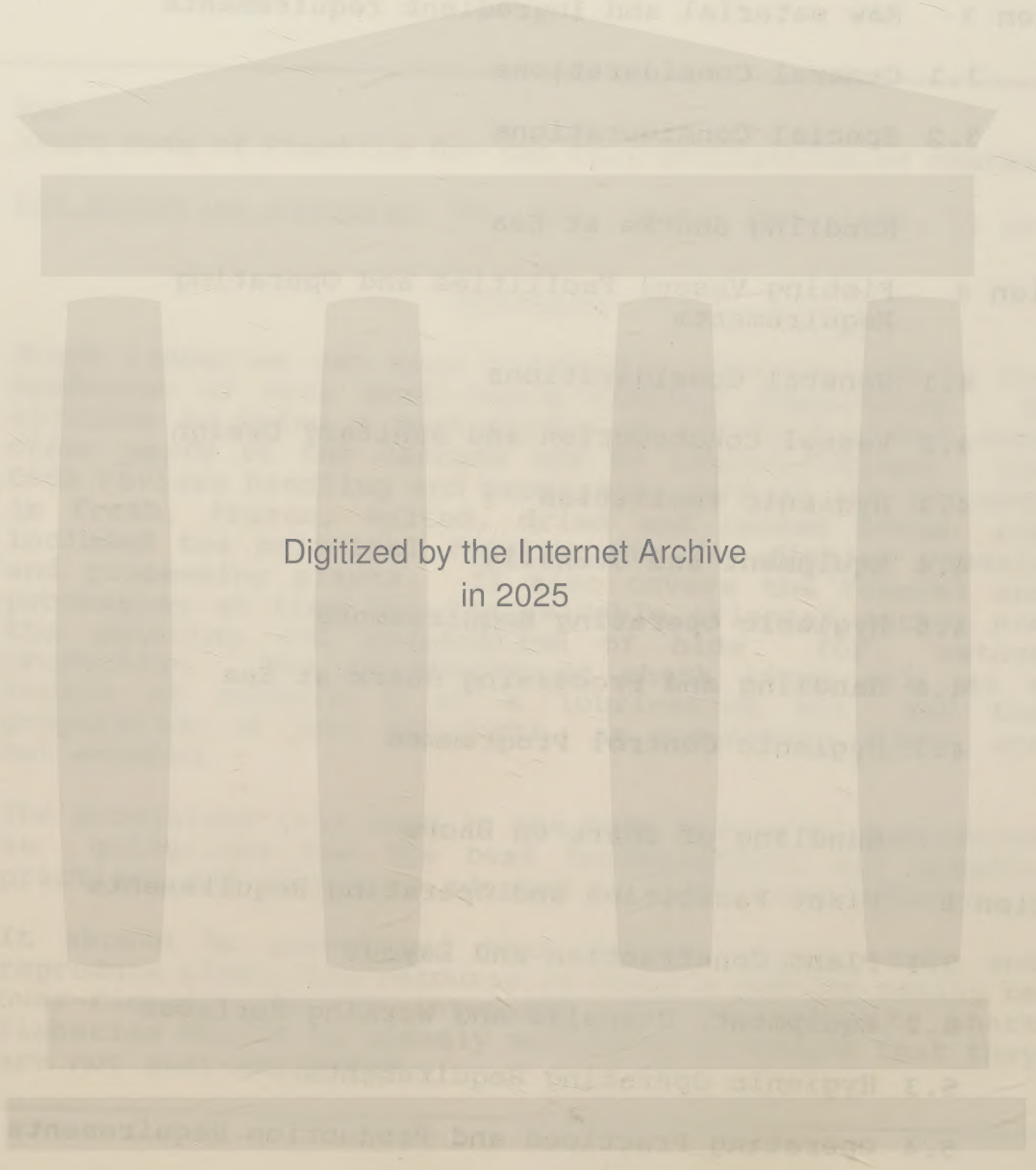

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DRAFT CODE OF PRACTICE FOR SHARKS

Note

The hygienic and some of the technological requirements of this code are partially based on FAO-WHO Recommended International Codes of Practice - General Principles of Food Hygiene, the Recommended International Codes of Practice for Fresh Fish, Canned Fish, Frozen Fish, Shrimps and Prawns, Lobsters, Smoked Fish, Salted Fish, Minced Fish Prepared by Mechanical Separation, Crabs, and the Draft Code of Practice for Cephalopods.

The letter and number codes given in brackets following a paragraph indicate requirements taken from the following documents:

Recommended International Codes of Practice for:

Fresh Fish	FF
Canned Fish	CF
Shrimps and Prawns	SP
Frozen Fish	FR
Lobsters	LB
Smoked Fish	SM
Salted Fish	SA
Minced Fish Prepared by Mechanical Separation	MF
Crabs	CB
General Principles of Food Hygiene	FH
Draft Code of Practice for Cephalopods	CP
Modified in substance for the purpose of this Code	Mod

In general, where there are similar requirements in two or more codes, the latest or most appropriate document was used.

Section 1 - SCOPE

This Code of Practice applies to sharks, meaning numbers of the Class Chondrichthyes belonging to the orders Squatiniformes, Pristiophoriformes, Squaliformes, Hexanchiformes, Carcharhiniformes, Lamniformes, Orectolobiformes, and Heterodontiformes intended for human consumption and some related alternate uses.

It contains the technological and guidelines and the essential hygiene requirements for harvesting, processing and handling of sharks at sea and on shore for meat, fins and hides. The technology of canning shark and shark oil processing is not covered in this code.

Section 2 - DEFINITIONS

For the purpose of this code:

2.1 "adequate or appropriate" means sufficient to accomplish the intended purpose of this code; (MF 2.1/Mod)

2.2 "autolysis" is the breakdown or deterioration of the shark meat or viscera by means of endogenous enzymes; (CP 2.1)

2.3 "brining" means the process of placing shark meat or its parts in a solution of salt and water of an appropriate quality for a period of sufficient length for the shark tissue to absorb a desirable quantity of salt; (CP 2.3/-Mod)

2.4 "chilling" is the process of cooling sharks to a temperature approaching that of melting ice; (CP 2.4)

2.5 "clean sea water" is sea water which meets the same microbiological standards as potable water and is free from objectionable substances; (CP 2.7)

2.6 "cleaning" means the removal of soil, food residues, dirt, grease or other objectionable matter; (MF 2.5)

2.7 "contamination" means the occurrence of any objectionable matter in the product; (MF 2.6)

2.8 "disinfection" means the reduction, without adversely affecting the product, by means of hygienically satisfactory chemical agents and/or physical methods, of the number of micro-organisms to a level that will not lead to harmful contamination of the product; (MF 2.7/Mod)

2.9 "dry-salting or kench curing" is the process of mixing shark with dry salt in such a manner that the resulting brine drains away; (SA.9)

2.10 "flaying or skinning" is the removal of a hide or skin from a carcass.

2.11 "pickling or pickle curing" is the process whereby shark is mixed with salt and is stored under the resultant brine (pickle) which forms by solution of salt in the water extracted from the shark tissue; (SA 2.19)

2.12 "pests" are any animals capable of directly or indirectly contaminating the product; (MF 2.24/Mod)

2.13 "plant or establishment" means any building(s) or area(s) in which shark is handled after harvesting and the surroundings under the control of the same management; (MF 2.25)

2.14 "potable water" is fresh water fit for human consumption. Standards for potability should not be lower than those contained in the latest edition of the "International Standards for Drinking Water", World Health Organization; (MF 2.26)

2.15 "salt" means salt (sodium chloride) of an appropriate quality and otherwise suitable for the purpose; (SA 2.27)

Section 3 - RAW MATERIAL AND INGREDIENT REQUIREMENTS

3.1 General Considerations

3.1.1 SHARK INTENDED FOR MARKETING FRESH OR FOR FREEZING SHOULD BE OF THE HIGHEST POSSIBLE QUALITY. SHARK INTENDED FOR SALTING SHOULD BE OF GOOD QUALITY.

Shark meat is more difficult to handle than fish meat. This is a consequence of biological and physiological differences between fish and shark. A major difference is that while urea is formed in blood and body fluid of all marine fish both bony and cartilaginous, bony fish excrete urea quickly but sharks retain it in their blood. The urea gives the meat a specific smell and a sour-bitter (acid) taste, and can quickly form ammonia through bacterial action giving an impression of spoiled product. Thus the meat of sharks has often a particular taste and is considerably more sensitive to post mortem changes than the meat of bony fish and, indeed, the meat cannot be preserved properly unless adequate handling practices are applied.

Freezing and frozen storage cannot improve the quality of fish. At best, the process maintains the fish in much the same condition as it was immediately before freezing. It is therefore essential that the raw material be as fresh as possible.

3.1.2 FRESH SHARK IS AN EXTREMELY PERISHABLE FOOD, AND SHOULD BE HANDLED AT ALL TIMES WITH GREAT CARE AND IN SUCH A WAY AS TO INHIBIT MULTIPLICATION OF MICRO-ORGANISMS

The multiplication of micro-organisms must be kept as low as possible in order to maintain fresh quality, particularly as bacteria split ammonia from urea in sharks at a very early stage. Shark quality deteriorates rapidly, and the potential keeping time is shortened if it is not handled and stored properly. Some shark landed for human consumption is unfortunately subjected to fairly rough handling treatment which should be avoided.

Shark should not be exposed to direct sunlight or to the drying effect of winds, or any other harmful effects of the elements. Depending on its use, sharks should be carefully cleaned, bled and cooled down to the temperature of melting ice, 0 deg. C. (32 deg. F.), as quickly as possible or frozen. Any careless treatment or delay in reducing the temperature of the shark will have a marked effect on its potential keeping time. (FF 3.3.1/Mod)

3.1.3 NO SHARK WHICH HAS DETERIORATED, OR IS DECOMPOSED OR IS CONTAMINATED TO AN EXTENT WHICH RENDERS IT UNFIT FOR HUMAN CONSUMPTION, SHOULD BE USED FOR HUMAN FOOD.

Raw material should be rejected if it contains harmful, decomposed or extraneous substances which will not be removed to acceptable levels by normal procedures of shorting preparation. Sharks which are unwholesome should be discarded.

3.1.4 FRESH SHARK INTENDED FOR FREEZING, SALTING, SMOKING OR CANNING (RETORTING) SHOULD RECEIVE THE SAME CARE AND ATTENTION FROM THE TIME OF CAPTURE UNTIL THEY ARE PROCESSED AS THOSE INTENDED FOR MARKETING FRESH

The processes and the principles involved in the preparation of shark and its products for further processing are for the most part similar to those that should be involved in preparing them for marketing as fresh. Therefore, the recommendations of the "Recommended International Code of Practice for Fresh Fish" (Ref. No. CAC/RCP 9-1976), and where applicable, the "Recommended International Code of Practice for Frozen Fish" (Ref. No. CAC/RCP 16-1978), and the "Recommended International Code of Practice for Salted Fish" (Ref. No. CAC/RCDP 26-1979) should be used as a guide for the handling and preparation of shark for further processing. Shark intended for skinning represents a different case. (SA 3.1.2/Mod)

3.1.5 SALT OF A SUITABLE QUALITY AND CRYSTAL SIZE SHOULD BE USED

Sea salt requirements in Sub-Section 5.4.10.

3.2 Special Considerations

3.2.1 KNOWLEDGE OF FISH SPECIES AND LOCAL CONDITIONS ARE ESSENTIAL

Toxicity of a sporadic nature has been reported with many groups of fish including sharks through the world. For example, Greenland shark meat (Somniosus microcephalus) is used fresh and dried for human and sled-dog food. The meat is said to be toxic when fresh, unless carefully washed, but is harmless dried or semi-putrid. The eating of certain organs of this shark has also caused many outbreaks of intoxication but the poison has not been identified.

As sharks are on the high end of the food chain and generally live a long life, they tend to accumulate marine contaminants such as heavy metals (eg. mercury). Such contaminants may be from either an artificial or a natural source, widespread or localized, and may result in a species or area fishing closure, or discarding sharks of a certain size or weight, as required by the official agency having jurisdiction.

3.2.2 SHARK INTENDED FOR SKINS NEED CAREFUL CONSIDERATION

While in principle skins (hides) of most sharks can be used, this is difficult to achieve in industrial practice because not all sharks are suitable due to size and biological features. Generally skins can be produced from sharks of more than 1.5 m. in length but an experienced skinner is required to decide whether a skin is worth taking and curing. Most skins of large female whales are damaged by bites and scars inflicted on them by male sharks when mating, and such hides have a low commercial value or none at all. Further, the meat of sharks which will be used for skins is generally not suitable for frozen products if they are skinned on shore as they should neither be gutted nor iced or frozen before skinning; therefore

the meat is at a disadvantage in regard to quality compared to meat of sharks iced at sea. As sharks spoil more rapidly than other fish, the maximum skinning and salting time limit should not exceed 24 hours, and in warm and humid climates this period may be reduced to a few hours. The economics of utilization for skins or meat in terms of shark species, length, availability and marketability have to be carefully worked out.

HANDLING OF SHARKS AT SEA

Section 4 - FISHING VESSEL FACILITIES AND OPERATING REQUIREMENTS

4.1 General Considerations

4.1.1 THE FISHING VESSEL SHOULD BE DESIGNED FOR RAPID AND EFFICIENT HANDLING OF SHARKS, EASE OF CLEANING AND DISINFECTION, AND SHOULD BE OF SUCH MATERIAL AND CONSTRUCTION AS NOT TO CAUSE ANY DAMAGE OR CONTAMINATION OF THE CATCH

In designing a shark fishing vessel, many other factors, apart from the vessel's performance as a harvesting unit, should be considered. Contamination of sharks with bilge water, sewage, smoke, fuel, oil, grease or other objectionable substances must be avoided. The catch should be protected against physical damage, exposure to high temperatures and the drying effects of sun and wind.

All surfaces with which the sharks might come in contact should be of suitable corrosion-resistant material which is smooth and easily cleanable. (SA 4.1.1.1/Mod)

If a vessel is engaged in the processing of shark at sea it should be large enough to allow for processing and installation of proper equipment and an adequate product storage. Its design, layout, construction and equipment should meet the requirements of shore establishments and the processing should be carried out under similar hygienic conditions. (SA 4.1.1.1/-Mod)

4.1.2 THE VESSEL SHOULD BE ADEQUATE FOR THE INTENDED FISHERY

Shark fishing is extremely varied in species caught, quantity, size of shark, gear used and utilization. The vessel should be equipped to process the shark (skin, freeze or salt) at sea if the fishery cannot be operated within the maximum storage life of iced or un-iced shark.

If a vessel is engaged in the processing of shark at sea, it should be large enough to allow for processing and installation of proper equipment and an adequate product storage. Its design, layout, construction and equipment should meet the requirements of shore establishments and the processing should be carried out under similar hygienic conditions.

4.2 Vessel Construction and Sanitary Design

4.2.1 DECK POUNDS OR PENS, STANCHIONS AND DIVIDING BOARDS AND HOLDING TANKS SHOULD BE CONSTRUCTED OF SUITABLE CORROSION-RESISTANT MATERIAL. THEY SHOULD BE ADEQUATE IN NUMBER AND HEIGHT TO PREVENT CRUSHING OF THE SHARKS DUE TO EXCESS WEIGHT OR TO THE VESSEL'S MOTION, AND TO HOLD THE ESTIMATED CATCH

In practice, wood is still used in many fisheries for deck pound boards and steel for stanchions and other fixtures. Where this is the case, the wood should be treated to prevent the entry of moisture and should be coated with a durable non-toxic paint or other non-toxic surface coating that is smooth, readily cleanable and light colour. Steelwork should be coated with an anti-corrosion non-toxic paint. Whenever possible, suitable corrosion-resistant materials should be used. If shark is salted at sea, attention should be drawn to special materials able to withstand high concentrations of salt. (SP 4.1.2.1/Mod)

4.2.2 VESSEL HOLDS OR TANKS FOR STORAGE OF ICED SHARKS, SHOULD BE ADEQUATELY INSULATED WITH A SUITABLE MATERIAL. ANY PIPES, CHAINS OR CONDUITS PASSING THROUGH THE HOLD SHOULD, IF POSSIBLE, BE SUNK FLUSH OR NEATLY BOXED IN AND INSULATED

Adequate insulation will reduce the amount of heat entering the hold and consequently the rate of ice meltage. If the quality and structure of the insulation is poor, considerable ice meltage will take place near bulkheads and shipside. Adequate insulation will permit longer storage of fresh shark prior to processing or provide more controllable conditions if shark is salted at sea. (CP 4.2.2/Mod)

4.2.3 HOLD OR TANK LININGS SHOULD BE COMPLETELY WATER-TIGHT. THE INSULATION LAYER SHOULD BE PROTECTED BY A LINING MADE OF CORROSION-RESISTANT METAL SHEETS OR ANY OTHER EQUALLY SUITABLE NON-TOXIC MATERIAL HAVING WATERTIGHT JOINTS

It is important to prevent water from carrying dirt and offal to parts of the vessel where effective cleaning is virtually impossible. The melt water, seeping through the vessel hold lining, will also reduce the efficiency of the insulation and this will, in turn, lead to an increase in the temperature of the sharks. The insulation should be covered with corrosion-resistant metal sheets, or any other equally suitable material having watertight joints to ensure protection from such contamination. An effective drainage system should be able to remove the melt water into a sump as fast as it accumulates. (SP 4.1.2.3)

4.2.4 WOODEN HOLDS OR WOODEN HOLDING TANKS SHOULD BE LINED WITH A SUITABLE MATERIAL

The linings of wooden holds or tanks should be similar to those described above. They should be sealed and coated with a suitable impervious and non-toxic material which is easy to keep clean and not difficult to repair. However, if shark is to be dry-salted on board, it is not necessary to cover wooden

parts of the hold with metal especially if the wood is saturated with salt. (SA 4.1.2.6)

4.2.5 THERE SHOULD BE NO SHARP CORNERS OR PROJECTIONS IN THE HOLD OR TANK AS THESE WILL MAKE CLEANING DIFFICULT AND MAY DAMAGE THE SHARKS

Contamination with dirt and offal will build up rapidly on surfaces, in corners or around projections which are not smooth and impervious.

Any ledges or projections resulting from the encasement of pipes, wires, chains and conduits, that are passing through the vessel hold, should be so constructed as to allow free drainage, ease of cleaning and not to cause any physical damage to the sharks. (CP 4.2.5)

4.2.6 PORTABLE BOARDS OF SUITABLE CORROSION-RESISTANT MATERIAL OR IMPREGNATED AND PAINTED WOOD, SHOULD BE USED FOR MAKING SHELVES AND VERTICAL DIVISIONS IN THE HOLDS

The use of portable boards, which are a good fit in the stanchions, allows the shelf and dividing structure to be dismantled and removed for cleaning. Wooden boards should be treated to prevent the entry of moisture and should be coated with non-toxic paint or other equally suitable surface coating that is smooth, readily cleanable and repairable. Wherever possible, the shelving and the partitioning boards should be interchangeable in size. (CP 4.2.6)

4.2.7 SHELVING BOARDS SHOULD BE DESIGNED TO ALLOW ADEQUATE DRAINAGE

A continuous trickle of melt water will help to carry away slime and micro-organisms which should not be allowed to collect on the shelves. Corrugated boards of corrosion-resistant material are most suitable for this purpose. (CP 4.2.7)

4.2.8 THE SHELVES SHOULD BE INSTALLED SO THAT THE MAXIMUM DEPTH OF SHARKS WHEN BULK STOWING IS NOT EXCESSIVE

Experience has shown that the pressure towards the bottom of a deep pile of iced shark can result in weight loss and damage. Where iced shark are stowed in deep pounds, shelves should be fitted at frequent intervals, to transfer the weight of the load to the hold structure and hull, without undue pressure on shark stowed below. (SP 4.1.2.7)

4.2.9 THERE SHOULD ALWAYS BE AMPLE DRAINAGE SPACE BETWEEN THE LOWEST SHELVES OR THE "FALSE BOTTOM" AND THE FLOOR OF THE HOLD. THIS SPACE SHOULD BE OPEN TO A CENTRAL DRAIN, DISCHARGING DIRECTLY INTO ONE OR MORE SUMPS OR WELLS, LOCATED SO THAT THE HOLD CAN BE EFFICIENTLY DRAINED AT ALL TIMES. BILGE PUMP CONNECTIONS TO THESE SUMPS SHOULD BE FITTED WITH COARSE SCREEN FILTERS

Proper drainage facilities can prevent a build-up of large quantities of melt water, dirt and offal. If drainage is

inadequate, the bottom layers of the sharks in the hold may be contaminated by this dirty liquid, especially during the periods of severe motion of the vessel. Pumps, slush wells, bilges, etc. from the fish room should be completely separated from the engine-room bilge system to prevent contamination. (SP 4.1.2.8)

4.2.10 WHERE BOXING AT SEA IS CARRIED OUT, THE STANCHIONS AND DIVIDING STRUCTURE SHOULD BE DESIGNED TO ACCOMMODATE BOXES OF SHARK WITHOUT LEAVING LARGE AIR GAPS

If the structure is not designed to suit the box dimensions, large gaps will be left where the air can circulate causing excessive ice meltage. Unless these spaces are filled with extra ice the shark temperature will rise.

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4.2.11 IF COOLING GRIDS ARE FITTED IN THE HOLD THEY SHOULD BE PROPERLY INSTALLED AND OPERATED.

Cooling grids, fitted into the boat's hold, can be used to prevent excessive ice meltage during the voyage to the fishing grounds. They are valuable in cooling the hold and absorbing heat leaks, especially in tropical waters. To be effective they should be fitted under the deckhead and on the ship sides and, once the shark have been stowed in the hold, control must be such that the hold temperature does not fall below 0 deg. C (32 deg. F.). If it does, the top layer of ice may freeze into a solid crust, resulting in the freezing of the adjacent layer of shark thus affecting its quality.

If sharks are dry-salted on board, and are exposed to freezing temperatures, especially during the initial curing period, they will eventually turn sour and rancid. Salting and curing in salt should be done under cool and well controlled temperature conditions. (SP 4.1.2.10/Mod)

4.2.12 EXCEPT FOR TANK STOWAGE IN REFRIGERATED SEA WATER OR REFRIGERATED BRINE, THE BULK STOWAGE OF SHARKS IN HOLDS THAT ARE NOT DIVIDED INTO POUNDS WHICH COULD BE SHELVED IS NOT RECOMMENDED

Crushing of shark could result from either the excessive depth at which the sharks are stowed, or from horizontal shifting of large quantities of the ice mixture caused by the movement of the fishing vessel. In either case, the shark will be damaged considerably and the resulting loss in weight and quality will diminish the fisherman's income. (SP 4.1.2.11)

4.2.13 HOLDS THAT ARE NOT DIVIDED INTO POUNDS OR PENS SHOULD HAVE AN ADEQUATE NUMBER OF DRAIN LINES LOCATED AT INTERVALS ALONG THE HOLD, DISCHARGING TO A CENTRAL DRAIN OR BILGE. VERTICAL DRAIN SLOTS SHOULD BE LOCATED ALONG BOTH THE FORWARD AND AFT BULKHEADS RUNNING FROM DECKHEAD TO BILGE

As has already been stated, holds which are not divided into pounds are not to be recommended. Those which do exist in very small vessels also require adequate drainage facilities. This could be achieved by providing a "false bottom" with holes that will allow the melt water to drain. (SP 4.1.2.12)

4.2.14 BULKHEADS SHOULD BE CONSTRUCTED OF SMOOTH, NON-ABSORBENT, EASILY CLEANABLE MATERIAL

The fitting of removable type bulkheads increases the versatility of fishing vessels and prevents movement of the stowed fish. They also permit rapid conversion to other types of fish stowage. (SA 4.1.2.10)

4.2.15 IN ALL SHIPS USING REFRIGERATED SEA WATER OR REFRIGERATED BRINE SYSTEMS FOR HOLDING FISH, TANKS, HEAT EXCHANGERS, PUMPS AND ASSOCIATED PIPING SHOULD BE MADE OF, OR COATED WITH, SUITABLE CORROSION-RESISTANT MATERIAL. THEY SHOULD BE SO DESIGNED THAT THEY CAN EASILY BE CLEANED AND DISINFECTED

With hard, non-porous surfaces such as stainless steel, aluminium alloys or plastics, spoilage micro-organisms, together with all the debris deposited during storage of the sharks can be readily removed if the operation is performed immediately, thus reducing the risk of contaminating later catches. It is important to avoid corners, cracks and edges in which filth can lodge.

The whole system should be so designed as to allow an easy introduction and effective circulation of the cleaning and disinfecting solutions. There should be no place where proper cleaning cannot be carried out.

It is important to remember that with ice storage only part of a load may spoil but with refrigerated sea water or brine, any malfunctioning of the system or neglect on the part of operators can result in the whole catch being rejected for spoilage. (SA 4.1.2.11)

4.2.16 REFRIGERATED SEA WATER OR REFRIGERATED BRINE TANKS SHOULD BE INSULATED TO MINIMIZE HEAT LEAKAGE FROM THEIR SURROUNDINGS

The temperature of the refrigerated sea water will be more uniform through the tank and more easily controlled if the heat-leak from other sources is reduced by effective insulation. (SA 4.1.2.13)

4.2.17 REFRIGERATION PLANT AND SEA WATER OR BRINE CIRCULATING EQUIPMENT SHOULD BE ADEQUATE TO MAINTAIN THE TEMPERATURE CONSTANTLY LOW

There should be a sufficient compressor capacity to prevent a significant rise in temperature of the pre-chilled sea water or brine solution when the holding tanks are being loaded with freshly caught shark.

Rapid cooling of the shark is the primary task of the system. Once the initial cooling of the shark is accomplished, the subsequent maintenance of constantly low temperature requires only a fraction of the compressor's load. Thermal inertia of a large body of chilled shark and brine should prevent sudden and significant fluctuations in temperature. (SA 4.1.2.14)

4.2.18 WHERE CLEAN SEA WATER OR BRINE AND ICE MIXTURES ARE USED FOR COOLING AND STORING THE CATCH, THERE SHOULD BE ADEQUATE CIRCULATION OF THE LIQUID

Effective means of circulating the cold liquid round the mass of sharks should be provided. If pumping facilities are inadequate some of the load may not be cooled properly, resulting in sharks with highly unpleasant odours and flavours.

The holding tanks should be equipped with suction screen arrangements which are strong enough to withstand the pressure exerted by the brine-shark mixture, as well as negative pressure (suction) created by the circulating pump. Such screens should be so designed and located as to allow a constant and unobstructed flow of cold brine or sea water. (SP 4.1.2.18)

4.2.19 VESSELS ENGAGED IN NIGHT FISHING SHOULD HAVE SUFFICIENT DECK ILLUMINATION IN THE AREAS WHERE THE CATCH IS LANDED, SORTED, ICED OR PROCESSED

Inadequate lighting reduces efficiency, makes difficult the practice of proper hygienic and quality control procedures and increases the possibility of accidents. Lighting for the deck area is usually provided by mast spreader of boom lights. Care must be exercised that deck lighting does not mask or obliterate navigational lights. (SA 4.1.2.15)

4.3 Hygiene Facilities

4.3.1 DECK HOSES SHOULD BE SUPPLIED WITH CLEAN SEA WATER, AT ADEQUATE PRESSURE, BY A PUMP USED ONLY FOR CLEAN SEA WATER

A good supply of clean sea water, at adequate pressure, with an addition of chlorine, if possible, should be available.

The intake for sea water should be well forward of, and on the opposite side of, the vessel from the toilet, waste and engine cooling discharge. Sea water should not be used while the vessel is in harbour or in areas where there is a danger of it being polluted. Clean sea water should be taken in while the vessel is in forward motion.

The piping for the clean sea water supply should have no cross connections with the engine or condenser cooling system. It should be so constructed as to prevent any possibility of back-siphonage from the kitchen sink or toilets. (CP 4.3.1)

4.3.2 ICE SHOULD BE MADE FROM POTABLE WATER OR CLEAN SEA WATER AND SHOULD NOT BE CONTAMINATED WHEN MANUFACTURED, HANDLED OR STORED

Ice made from water which is neither potable nor clean sea water, may contaminate the sharks with water-borne micro-organisms or other objectionable or even harmful substances. Such contami- nation will result in the loss of quality, reduced keeping time and may create a health hazard.

When vessels are taking ice to sea, only fresh clean ice should be taken on board at the beginning of each voyage. Ice storage on board should be in an insulated hold. (CP 4.3.2)

4.3.3 THE VESSEL'S TOILET FACILITIES AND ALL PLUMBING AND WASTE DISPOSAL LINES SHOULD BE SO CONSTRUCTED AS NOT TO CONTAMINATE THE CATCH

All the plumbing and waste disposal lines servicing the vessel's toilets, hand wash basins or kitchen sinks, should be large enough to carry peak loads, be watertight and should not go through the holds where sharks are being handled or stored. (CP 4.3.3)

4.3.4 IF POISONOUS AND HARMFUL MATERIALS, INCLUDING CLEANING COMPOUNDS, DISINFECTING MATERIALS AND PESTICIDES, ARE STORED ON BOARD THE VESSEL, THEY SHOULD BE KEPT IN A SEPARATE COMPARTMENT RESERVED AND MARKED SPECIFICALLY FOR THIS PURPOSE

Extreme caution must be exercised to prevent poisonous or harmful materials from contaminating the sharks. All such materials should be prominently and distinctly labelled so that there can be no confusion between these and edible materials used aboard the vessel. Such compartments should be kept locked and the materials contained in them should be handled only by personnel trained in their use. (CP 4.3.4)

4.3.5 THE FISHING VESSEL SHOULD BE EQUIPPED WITH BRUSHES, SCRAPERS, WATER HOSES, SPRAY NOZZLES AND OTHER SUITABLE WASHING AND DISINFECTING EQUIPMENT

Although there is a variety of cleaning and disinfecting equipment available on the market, good quality hand brushes, of several sizes and shapes, are still the most inexpensive and versatile tools for cleaning operations. Brushes should be kept in a clean and sound condition, disinfected after each use (dipping in 50 ppm chlorine solution is recommended) and when not used, should be stored in a dry state. Unclean brushes could spread dirt and micro-organisms. Micro-organisms may proliferate in a dirty brush when stored in a wet condition. The use of steel wool for scouring should be avoided as there is a constant danger of introducing small, sometimes hardly visible, bits of wire into the final product. If for some reason cleaning cannot be done effectively with a good brush, then plastic, brightly coloured scouring pads might be used. High pressure and high frequency oscillating water or detergent spraying equipment has been found to be quite effective in cleaning, but it usually requires an experienced operator to prevent damage to painted surfaces. (CP 4.3.5)

4.3.6 AREAS OF THE DECK WHERE SHARK ARE HANDLED AND/OR PROCESSED, OR THE HOLD WHERE SHARK IS STOWED, SHOULD BE USED EXCLUSIVELY FOR THESE PURPOSES

All such areas should be well defined, be readily capable of being maintained in a clean condition, and should be kept clean.

Storage of fuel and other petroleum products, and of different cleaning and disinfecting agents, should be so arranged that there is no possibility of contamination of surfaces with which shark come in contact. Any exposure, even for a short time, of shark to petroleum products can result in rejection or eventual destruction of the whole load. (SP 4.1.3.1/Mod)

4.3.7 DEPENDING ON VESSEL'S SIZE, AN AMPLE SUPPLY OF COLD POTABLE WATER OR CLEAN SEA WATER UNDER ADEQUATE PRESSURE SHOULD BE AVAILABLE AT A SUFFICIENT NUMBER OF POINTS THROUGHOUT THE FISHING VESSEL. ON LARGE VESSELS ENGAGED IN SHARK PROCESSING, A SUPPLY OF HOT WATER AT A MINIMUM TEMPERATURE OF 65 DEG. C (149 DEG. F) SHOULD ALSO BE AVAILABLE

Only potable water or clean sea water should be used on sharks and on surfaces with which the shark might come in contact. Even if the sharks are caught in polluted waters, as occasionally happens, that water should not be used for washing shark or for the preparation of refrigerated sea water or refrigerated brine. (SP 4.1.3.2/Mod)

4.3.8 A SYSTEM FOR INJECTING CHLORINE INTO THE LINES OF SEA WATER WHICH IS USED IN THE PROCESSING OF SHARK OR FOR THE CLEAN-UP OF THE VESSEL SHOULD BE PROVIDED WHERE PRACTICABLE

It has been established in the fish processing industry that the injection of chlorine into a supply of cold water used for general wash-up helps to control microbial contamination.

The fishing vessels involved in handling or processing large quantities of shark might gain considerably in hygiene by having chlorine introduced into the water lines. Chlorine dosage should be around 10 ppm during the normal use and 100 ppm of residual concentration during the clean-up.

As a word of caution, the use of strongly chlorinated water in confined spaces, such as a vessel's hold, could prove objectionable to the operator. For that reason, a system for injecting chlorine should be capable of varying the amount of chlorine delivered.

There are a number of relatively inexpensive and easily operable instruments on the market that will perform this task with the minimum of maintenance. The installation of a chlorine injection system might not be practical for small fishing boats. (SP 4.1.3.3)

4.3.9 A SEPARATE COMPARTMENT SHOULD BE PROVIDED FOR THE STORAGE OF DRY INGREDIENTS

Dry ingredients, such as salt, etc., stored aboard the vessel for use in shark processing should be kept in a separate compartment protected from dampness and contamination. (SP 4.1.-3.8)

4.3.10 WHERE BAIT IS CARRIED, IT SHOULD BE HELD IN SUCH A MANNER THAT IT WILL NOT CONTAMINATE THE CATCH

On vessels which carry bait, a separate area or special container should be set aside for bait storage where bait could be held well protected and away from the catch.

When fishing is finished, the ice used for bait preservation should be discarded. (CB 4.3.5)

4.4 Equipment and Utensils

4.4.1 ALL SHARK HANDLING, CONVEYING, WASHING, PROCESSING, AND SKINNING EQUIPMENT, USED ON BOARD FISHING VESSELS, SHOULD BE DESIGNED FOR THE RAPID AND EFFICIENT HANDLING OF SHARK, BE SUITABLE FOR EASY AND THOROUGH CLEANING AND SHOULD BE CONSTRUCTED AS NOT TO CAUSE CONTAMINATION OF THE CATCH

When obtaining equipment, only equipment which can readily be disassembled for thorough cleaning should be considered. (FF 4.4.1/Mod)

4.4.2 ALL CONTAINERS USED FOR STOWING OF SHARKS SHOULD BE OF UNIFORM AND SUITABLE SIZE, EASY TO HANDLE WHEN LOADED, AND SHOULD BE CONSTRUCTED OF SUITABLE CORROSION-RESISTANT MATERIAL

Such containers, when fully loaded, should be easy to handle by one or two men without tilting, tipping or jerking.

If wooden boxes are used, they should be of a smooth construction and of durable, non-toxic and waterproof finish or should be new.

Baskets should not be used for handling sharks on board the vessel or on shore, as they are difficult to clean and disinfect. (CP 4.4.1)

4.4.3 ALL EQUIPMENT USED IN FREEZING AND FROZEN STORAGE OF SHARKS ABOARD THE VESSEL SHOULD MEET THE REQUIREMENTS OF THE RECOMMENDED INTERNATIONAL CODE OF PRACTICE FOR FROZEN FISH (CAC/RCP 16-1978)

Most of the recommendations made in that code would apply equally to freezing and frozen storage of sharks. (CP 4.4.2)

4.4.4 ALL EQUIPMENT USED IN SALTING OF SHARKS ABOARD THE VESSEL SHOULD MEET THE REQUIREMENTS OF THE RECOMMENDED INTERNATIONAL CODE OF PRACTICE FOR SALTED FISH (CAC/RCP 26-1979)

Most of the recommendations made in this code would apply equally to salting of sharks and their parts.

4.5 Hygienic Operating Requirements

4.5.1 VESSEL, EQUIPMENT, UTENSILS AND OTHER FACILITIES USED IN THE HARVESTING, HANDLING AND PROCESSING OF SHARK SHOULD BE KEPT IN GOOD REPAIR AND CLEAN

Repairs to equipment should be made as soon as they become necessary, and all equipment and utensils should be thoroughly cleaned after each cycle of use. A cleaning schedule should be drawn up and the crew instructed to adhere strictly to it.

4.5.2 BEFORE ANY SHARK COMES ON BOARD, AND BETWEEN EACH HAUL, DECKS, POUND OF PEN BOARDS AND ALL OTHER DECK EQUIPMENT WHICH WILL COME IN CONTACT WITH SHARK, SHOULD BE HOSED DOWN WITH CLEAN SEA WATER AND BRUSHED TO REMOVE ALL VISIBLE DIRT AND DEBRIS

The purpose of this washing is to remove all traces of contaminating matter such as blood, tar, oil, etc. which may cause discolouration and offensive odours in the shark.

It is also important to cool the surface of the deck and deck ponds by hosing them with cold clean water before the shark comes on board. During warm weather, the surface temperature of the deck may be very high. (SP 4.3.2/Mod)

4.5.3 ALL TUBS, TANKS, BARRELS AND OTHER EQUIPMENT USED IN HANDLING, WASHING AND CONVEYING OPERATIONS SHOULD BE THOROUGHLY CLEANED, DISINFECTED AND RINSED AFTER EACH CYCLE OF USE

Any dirt or offal if allowed to dry and accumulate on surfaces with which sharks come in contact, will be very difficult to remove later and will thus contaminate the subsequent loads of sharks. (SP 4.3.3)

4.5.4 DURING FISHING TRIPS THE VESSEL'S HOLD AND BILGE SUMP SHOULD BE DRAINED REGULARLY. THE SUMP SHOULD BE ACCESSIBLE AT ALL TIMES

Bilge water containing dirt and offal, if not regularly pumped out, will provide a medium for the multiplication of micro-organisms and give rise to offensive odours in the hold. (SP 4.3.4)

4.5.5 ADEQUATE PRECAUTIONS SHOULD BE TAKEN TO ENSURE THAT HUMAN AND OTHER WASTES FROM THE FISHING VESSEL ARE DISPOSED OF IN SUCH A MANNER AS NOT TO CONSTITUTE A PUBLIC HEALTH AND HYGIENE HAZARD

With man's increased concern for the protection of his environment, in some countries the disposal of any waste from any boat into the surrounding water is restricted by law.

Fishermen should be fully aware of their responsibilities in this regard. Discharge of animal, human or any other wastes from the fishing vessel into the sheltered waters close to inhabited areas, or over shellfish growing areas, should not be practised. (CP 4.3.11)

4.5.6 PARTS OF THE FISHING GEAR WHICH COME IN CONTACT WITH SHARK SHOULD BE FREED OF DEAD FISH AND ORGANIC MATERIAL AFTER EACH HAUL. ALL GEAR SHOULD BE THOROUGHLY CLEANED WHEN FISHING HAS CEASED

Dead fish and organic matter left in the nets will decompose and contaminate later catches. (FF 4.5.4)

4.5.7 SEA WATER WHICH HAS BEEN USED FOR COOLING ENGINES, CONDENSERS OR SIMILAR EQUIPMENT SHOULD NOT BE USED FOR WASHING SHARKS, DECK, HOLD OR ANY OTHER EQUIPMENT WHICH MIGHT COME IN CONTACT WITH SHARKS

The water used for cooling engines is usually at a higher temperature than fresh sea water and might be contaminated with oil or other petroleum products or contain rust and other by-products of metal corrosion.

Such water, therefore, will considerably accelerate spoilage of sharks by raising the temperature and might impart objectionable taste, odour or undesirable discolouration. (SP 4.3.6)

4.5.8 WHEN CLEANING AND HOSING OPERATIONS ARE CARRIED OUT, WHILE THE VESSEL IS IN PORT, POTABLE WATER OR CLEAN SEA WATER SHOULD BE USED

Harbour water is usually heavily polluted and should never be used for cleaning purposes. This is also true for sea water in the close vicinity of towns, villages, industrial plants, fish processing establishments and factory ships. (CP 4.5.5)

4.5.9 IMMEDIATELY AFTER THE CATCH IS UNLOADED THE DECK AND ALL DECK EQUIPMENT SHOULD BE HOSED DOWN, BRUSHED, THOROUGHLY CLEANED WITH A SUITABLE CLEANING AGENT, DISINFECTED AND RINSED

Guts, slime and other residue left on the deck will support multiplication of micro-organisms which may contaminate future catches., If allowed to dry, dirt and offal are very difficult to remove.

Thorough cleaning should always precede disinfection, especially when chlorine is used as the disinfecting agent. Any organic matter which is not removed from the surfaces that are to be disinfected, will rapidly combine with an neutralize the micro-organism killing ability of chlorine or any other disinfectant. (CP 4.5.7)

4.5.10 AT THE END OF EACH TRIP ANY UNUSED ICE WHICH HAS BECOME CONTAMINATED SHOULD BE DISCARDED

Despite all precautions, unused ice in the hold can become contaminated and contaminate the new catch. Any contaminated ice should be discarded. (CP 4.5.7)

4.5.11 IMMEDIATELY AFTER THE CATCH IS LANDED THE HOLD AND BILGE SUMP SHOULD ALSO BE EMPTIED COMPLETELY. ALL SURFACES IN THE HOLD, POUND BOARDS AND SUMP SHOULD BE THOROUGHLY CLEANED WITH A SUITABLE CLEANING AGENT, DISINFECTED AND RINSED

This is necessary to remove all dirt, offal and other residue as soon as the catch is landed, in order to avoid multiplication of micro-organisms, offensive odours and the drying of residues on the hold or other surfaces. Cleaning should be completed before fresh ice is taken on board for the next trip. (SP 4.3.12)

4.5.12 CLEANING, WASHING AND DISINFECTING PROCEDURES SHOULD BE EFFECTIVE

Detergents and disinfectants should conform to public health requirements and should not be allowed to come into contact with sharks. Any residue of cleaning agents used for washing of boats and equipment, should be removed by thorough rinsing with potable fresh or clean sea water before the area or equipment is used again for stowing or handling sharks.

In choosing and applying different detergents, sanitizers and disinfectant, one should be fully aware of their properties and limitations. Many agents are effective only when prepared and used in strict accordance with the manufacturer's recommendations.

Temperature of the solution, its acidity or alkalinity concentration of the active ingredient, present of other chemicals, kind of surface to be treated or type of soil (dirt) and mode of application, are some of the factors that will determine the usefulness of the agent. Different agents should not be combined since one agent may neutralize the activity of another. (SP 4.3.15)

4.5.13 EMPTY VESSEL HOLDS OR STORAGE TANKS SHOULD BE VENTILATED

Strong odours associated with mildew, stagnant humid air and decomposing organic matter will develop in the absence of ventilation. All the containers, pails, boxes and tubs, after washing and sanitizing, should be stacked in such a way as to permit sufficient aeration. (SP 4.3.16)

4.5.14 IN VESSELS USING REFRIGERATED SEA WATER OR REFRIGERATED BRINE SYSTEMS FOR HOLDING OR CHILLING OF THE CATCH, ALL TANKS, PUMPS, HEAT EXCHANGERS AND OTHER ASSOCIATED EQUIPMENT SHOULD BE CLEANED IMMEDIATELY AFTER DISCHARGING THE CATCH. POTABLE WATER OR CLEAN SEA WATER CONTAINING A SUITABLE CLEANING AGENT SHOULD BE CIRCULATED THROUGH ALL PARTS OF THE SYSTEM. TANKS SHOULD BE INSPECTED CAREFULLY AND CLEANED OUT BY BRUSHING, IF NECESSARY

Since anaerobic micro-organisms are particularly active under tank storage conditions, a very high standard of hygiene is required to avoid the build-up and spread of infection from one tank to another.

Immediately after unloading, when surfaces are still wet, the holding tanks should be washed with cold potable water or cold clean sea water under adequate pressure, then scrubbed with a brush using an alkaline detergent solution and rinsed with warm and cold potable water or clean sea water.

All pumps, pipes and heat exchangers should be thoroughly flushed with clean cold potable water or cold clean sea water, followed by circulating through the system either a hot alkaline solution or cold water to which a strong cleaning agent has been added. After rinsing with potable water or clean sea water, a suitable disinfectant should be circulated through the system. It has been regarded by many fishermen as good practice to leave a weak solution of a non-corrosive disinfectant in the system. This, of course, must be drained and rinsed out thoroughly with potable water or clean sea water before the tanks are filled with shark. (SP 4.3.17)

4.5.15 WHERE REFRIGERATED SEA WATER IS USED FOR HOLDING OR CHILLING OF SHARK, ONLY CLEAN SEA WATER SHOULD BE USED AND SHOULD BE CHANGED AS OFTEN AS POSSIBLE TO PREVENT THE ACCUMULATION OF CONTAMINATING MATERIALS

Use of sea water contaminated with sewage or industrial discharges will affect the quality of the catch or render it unfit for human consumption. It is advisable for fishermen to check with the local authorities which areas are likely to be free of pollution. The intake for the vessel's sea water pump should be located on the opposite side away from sewage, waste discharge and engine cooling water outlets of the boat. Clean sea water should be taken in while the vessel is in forward motion. (SP 4.3.18)

4.5.16 EFFECTIVE MEASURES SHOULD BE TAKEN TO PROTECT THE FISHING VESSEL AGAINST INSECTS, RODENTS, BIRDS OR OTHER VERMIN

Rodents, birds and insects are potential carriers of many diseases which could be transmitted to man by contamination of the catch. Fishing vessels should be regularly examined for evidence of infestation and, when required, effective control measures should be taken.

All rodenticides, fumigants, insecticides and other harmful substances should be used only in accordance with the recommendations of the appropriate official agency having jurisdiction. (CP 4.3.12)

4.5.17 DOGS, CATS AND OTHER ANIMALS SHOULD BE EXCLUDED FROM AREAS OF THE VESSEL WHERE SHARKS ARE RECEIVED, HANDLED, PROCESSED AND STORED

Because of public health hazards and for aesthetic reasons, no surface of the fishing vessel and of the equipment

thereon which comes in contact with sharks, should be exposed to contamination with animal hair or excreta. (CP 4.3.13)

4.5.18 FOOD SUPPLIES FOR THE VESSEL'S KITCHEN OR FOR THE CREWS MESS SHOULD NEVER BE STORED IN ICE BINS WHERE SHARK IS KEPT

Storage of such materials in ice intended for shark might contaminate the ice and the shark. (CP 4.3.14)

4.6 Handling and Processing of Shark at Sea

4.6.1 General Considerations

4.6.1.1 DURATION OF THE TRIP FOR A SHARK HARVESTING VESSEL SHOULD BE DETERMINED BY THE TYPE OF FISHERY AND UTILIZATION OF THE CATCH, FACILITIES AVAILABLE ON THE VESSEL FOR HANDLING AND KEEPING THE CATCH, DISTANCE FROM THE PROCESSING PLANTS OR MARKETS AND THE LOCAL ENVIRONMENT CONDITIONS

From the time the sharks are caught, there is a continual and irreversible deterioration in quality. The progress and degree of such deterioration is governed mainly by the duration of time the sharks are held and the temperatures at which they are handled and stored on board the harvesting vessel. Where ice cannot be used, fishing times must be strictly limited. With short distances from the processing plant and market, more time might be spent on the fishing grounds, providing the boat is equipped with adequate facilities to handle or process and effectively chill and hold the catch at low temperature. With more distant fishing grounds proper salting and/or freezing and freezer facilities should be provided. (SP 4.4.1.1/Mod)

4.6.1.2 VESSELS ENGAGED IN OTHER FISHERIES SHOULD OBSERVE THE RELEVANT CODES OF PRACTICE FOR THEIR FISHERY IN ADDITION TO SPECIFIC INFORMATION CONCERNING SHARK CONTAINED IN THIS CODE

By far the largest landings of shark come as a "by-catch" or incidental catch when fishing for other kinds of fish. The Codex Alimentarius Commission, Recommended International Codes of Practice for Fresh Fish (CAC/RCP 9-1976), Frozen Fish (CAC/RCP 16-1978), and Salted Fish (CAC/RCP 26-1979) give information on handling and processing of fish at sea in general.

4.6.1.3 TOTAL SHARK UTILIZATION SHOULD BE ENCOURAGED

A sizeable portion of the shark catch is discarded at sea after removal of fins or livers because of the poor economics of transporting shark meat for sale as food, or, for that matter, for any other purpose. Profitability of shark fishing should be based on utilization of the total animal; meat, fins, hide, liver, teeth and offal. Ideally, this would entail skinning and curing the hides for shipment to a leather tannery; removing and drying the fins for sale to oriental food suppliers; freezing the choicest meat for the upscale market;

salting and drying lower quality meat for traditional markets and using the remaining carcass meat for bait or for fish meal production. However, not all species can provide the fishery with commercial yields of all the shark products referred to above. The value placed on their physical components varies not only with size and species but also with the end-use to which such components are put to. While almost all species are edible, the premium as far as meat is concerned, is enjoyed by the smaller shark which cannot yield hides and fins. For hides and fins, the premium belongs to bigger sizes, but the meat is less rewarding in economic terms. Careful consideration of how to utilize the catch, and strict adherence to quality considerations as outlined in this code may help overcome some of the difficulties.

4.6.1.4 THE TIME OF FISHING SHOULD BE KEPT SHORT

Sharks will deteriorate rapidly if the fishing gear is left too long in the water after death.

4.6.2 Handling the Catch on Board

4.6.2.1 DEPENDING ON SPECIES AND WHEREVER PRACTICABLE, SHARKS SHOULD BE KILLED OR STUNNED AS SOON AS THEY ARE TAKEN ON BOARD THE VESSEL AND CARE SHOULD BE TAKEN BY THE FISHERMAN IN HANDLING THE CATCH

Some of the larger sharks are extremely dangerous and must be killed before they can be further handled. Even smaller sharks such as the piked dogfish (Squalus acanthias) can be a hazard to those who catch it because of its sharp teeth and fin spines which in this case are toxic. The piked dogfish can curl itself and whip its tail about to inflict wounds with the long, sharp, second dorsal spine. The toxin is mildly irritating to most people, but some people can have a strong allergic reaction to it and require hospital care.

If the shark is allowed to struggle and thrash about on deck, it may not only be badly bruised, but may become exhausted before it dies, and its quality impaired. Stunning should be done only on the head and, with some species, preferably while the shark is still in the water.

4.6.2.2 HANDLING THE CATCH SHOULD BEGIN AS SOON AS IT COMES ON BOARD. ANY SHARK OR FISH UNSUITABLE FOR HUMAN CONSUMPTION SHOULD BE REMOVED FROM THE CATCH AND KEPT SEPARATE

Sorting the catch should be done as soon as the sharks are taken on board, to remove as quickly as possible shark unsuitable for human consumption. Mixed species catches should also be sorted rapidly not only for the reason stated above but also to avoid possible damage to fish due to abrasions, particularly when the catch contains spiny and rough skin species like shark, and to prevent transferring undesirable odours and tastes which may affect the organoleptic quality of the differing species. (FF 4.7.2/Mod)

4.6.2.3 SHARKS SHOULD BE INSPECTED AND SORTED FOR INTENDED UTILIZATION

Shark composition and landings can be mixed, and given the type of fishery operation, composition and species of catch, consideration must be made with regard to products and markets. After studying the above, a general decision on the use of the sharks should be made regarding use of oil, fins, hides or meat. Depending on utilization, the shark will be treated differently onboard the vessel. For example, sharks above a certain size may be used in the production of hides. In this case they should neither be gutted or be iced or frozen before skinning. Smaller sharks may be used for meat and should be iced at sea and kept in ice prior to processing or frozen.

Exceptions, of course, exist. Some sharks, for example, have a very valuable skin while the meat is practically wor thless, e.g. the nurse shark (Ginglymostoma cirratum). The meat of the shortfin mako shark (Isurus oxyrinchus) on the other hand may be so valuable in many markets that even large animals may be used if the market accepts them.

Hides should be inspected to determine whether they are worth taking and curing. Most skins of large female sharks are damaged by bites and scars, and such hides have a low commercial value or none at all.

Fins of the right size will always find a market but not all sharks have large enough fins. The value of livers varies greatly depending on country of catch and utilization of the shark oil. High value livers with a squalene content of at least 80% are found only in a limited number of deepwater sharks.

4.6.2.4 WHERE IT IS REQUIRED TO KEEP SPECIES UNSUITABLE FOR HUMAN FOOD OR FOR HIDES, THESE SHOULD ALWAYS BE SORTED FROM THE ICED AND/OR EDIBLE CATCH AND KEPT SEPARATE AT ALL TIMES

If sharks, unsuitable for human food, are brought back to port as, for example, for fish meal manufacture, care should be taken to avoid contamination of the edible catch. Sharks intended for hides should be kept separate from those intended for fresh or frozen meat. (FF 4.6.3/Mod)

4.6.2.5 SHARKS SHOULD NOT BE TRAMPLED OR STOOD UPON AND SHOULD NOT BE PILED DEEPLY ON DECK

Any physical damage, whether it be crushing, bruising, rubbing or scraping assists spoilage and reduces the value of the shark for subsequent processing purposes. (FF 4.6.6)

4.6.2.6 ALL SHARKS ON DECK SHOULD BE PROTECTED FROM SUN, FROST AND THE DRYING EFFECTS OF WIND

It is essential to prevent the sharks temperature from rising. Each degree of rise in temperature increases the rate of spoilage. If the catch is to be on deck for any length of time, it should be protected by an awning, ice, or even a wet, clean canvas or burlap. Drying will lower market value by spoiling the appearance and possibly inducing rancidity. Slow

freezing of the catch on deck, in areas where very low temperatures are encountered, should also be avoided.

If the vessel is undecked, then a clean container, preferably insulated and lidded, should be provided for the protection of the catch. (FF 4.6.5)

4.6.2.7 MOST SHARKS SHOULD BE BLED IMMEDIATELY AFTER LANDING ON DECK

A primary factor for obtaining good quality shark meat is the removal of the blood. Although the muscle and blood of shark contain urea the content in the blood is higher. Urea is the source of ammonia which is a characteristic of spoiled shark. Bleeding the animal must be carried out before the blood is coagulated. The most effective method is to chop off the caudal fin after stunning while the heart continues to beat. The application of this method, wherever possible, is recommended. Other methods involve making cuts in the heart, or the peritoneal region, and for some species heading and gutting the shark and inserting a water hose into the main vein to eliminate the blood by a jet of water. Hanging may facilitate bleeding, which could take up to one hour.

Small species such as the dogfish (Sq. acanthias) are not bled but immediately after capture put on ice or frozen. The practice of handling dogfish differently from other sharks and the resulting red meat are generally accepted as this species is exceptionally rough to handle.

4.6.2.8 IF SHARKS ARE GUTTED, GUTTING SHOULD COMMENCE AS SOON AS THE CATCH COMES ON DECK

The reasons for prompt gutting are, firstly, to sever some of the main blood vessels allowing the shark to bleed and, secondly, to remove the stomach and gut which would otherwise cause a softening of the flesh and accelerate spoilage. Sharks in which the guts are full of food will spoil even more rapidly. Although immediate gutting is desirable with some species, the catch of others cannot be handled rapidly enough, and advantages gained by gutting may be offset by quality loss resulting from rises in fish temperature. In such circumstances it would be preferable to get the shark under cover and to chill quickly, rather than delay the chilling operation by gutting. Further, dogfish (Sq. acanthias) and similar species are particularly susceptible to rancidity and oxidation in both iced and frozen storage which may be accelerated by gutting. (FF 4.6.8/Mod)

4.6.2.9 GUTTING SHOULD BE COMPLETE AND CARRIED OUT WITH CARE. BAD GUTTING MIGHT BE WORSE THAN NO GUTTING AT ALL. SHARK GUTS SHOULD NOT BE ALLOWED TO CONTAMINATE OTHER SHARKS OR FISH ON DECK

Pieces of gut or liver, if not completely removed, will act as centres from which spoilage will develop. Enzymes from pieces of gut and liver will digest the flesh and facilitate the entry of micro-organisms. Careless gutting, for example, cutting beyond the vent of a shark, will also allow the entry of micro-organisms into the flesh. Nevertheless, cuts should

be adequate to allow easy access to the belly cavity and complete removal of guts.

Guts contain digestive enzymes and spoilage micro-organisms. If allowed to foul the rest of the catch, the spoilage rate will be increased. This contamination can be prevented by dropping guts into suitable watertight containers or chutes discharging over the ship's side. (FF 4.6.11/4.6.12/ Mod

4.6.2.10 SEPARATE AND ADEQUATE STORAGE FACILITIES SHOULD BE PROVIDED FOR THE LIVERS AND OTHER INTERNAL ORGANS IF THESE ARE SAVED FOR LATER UTILIZATION

The size and weight of a shark's liver vary with the species of the shark and with the season of the year. Although Vitamin A from shark liver oil has been widely replaced by synthetic Vitamin A, the former is still used in some countries. Shark liver oil and other parts of sharks can be used as raw material for pharmaceutical products, an auxiliary in the textile and tanning industries, and as a lubricating oil with exceptional friction and heat-resisting qualities. Some types of shark liver oil are valued by the cosmetic industry for their squalene content.

It is necessary to take into consideration the distance from the fishing grounds to the nearest landing place, and know the maximum permissible delay with regard to preserving or processing the livers in order to avoid substantial reduction of the initial content of the desired end product (vitamins, squalene, etc.) in order to find out the type of preservation of the livers required such as icing or freezing. It has been reported that oil which is intended for aqualene production should be preserved within 15 minutes after the death of the animal.

4.6.2.11 IMMEDIATELY AFTER GUTTING, SHARKS SHOULD BE WASHED WITH CLEAN SEA WATER OR POTABLE WATER

Sharks should be thoroughly washed with clean sea water or potable water before being placed under refrigeration to remove all blood, slime and pieces of gut. Shark blood coagulates rapidly and washing will facilitate more complete bleeding, which in turn will improve the appearance of the product. If tanks are used for washing gutted sharks, a continual flow of potable water or clean sea water should be provided to prevent the accumulation of contaminating materials. The practice, common in some inshore fisheries, to gut the wash shark close to land involves the risk of using polluted sea water, and should therefore be discouraged. Harbour water, which is always polluted in some way, should never be used for washing shark. (FF 4.6.14)

4.6.2.12 WHERE RAPID GUTTING IS NOT PRACTICABLE WHOLE SHARK SHOULD BE WASHED AND CHILLED OR FROZEN AS SOON AS IT COMES ON DECK

Washing helps to remove filth and gut contents, and helps to prevent excessive contamination during subsequent

gutting and handling. Rapid chilling or freezing will preserve the quality of the catch. (FF 4.6.9/Mod)

4.6.2.13 ON COMPLETION OF WASHING THE SHARKS, FURTHER HANDLING OR PROCESSING SHOULD BE CARRIED OUT WITHOUT DELAY

At higher temperatures a delay of one hour can have a serious effect on the quality of the final product.

4.6.3 Processing the Fins on Board

4.6.3.1 FINS SHOULD BE CUT FROM THE SHARK AS SOON AS THE FISH IS CAUGHT

Care is needed in the cutting and trimming of shark fins, otherwise their value is reduced. Fins are cut from the shark in their finished form. This is different for every fin. The lower part of the tail is cut off with a straight cut right under the thick cartilage that runs through the tail, keeping clear of the meaty parts. The upper part of the tail has no value, as it contains no fibres. The dorsal fins have more meat at its base and should be cut with a broadly curved concave cut so as to eliminate the meat, but preserving as much of the fin as possible. The two pectoral fins have a solid meaty base. All this meat must be cut away leaving a gap that is called a "half moon cut". Cutting the meat away from a dried fin is harder than cutting it correctly the first time, and the fin will have become smelly, reducing its quality.

4.6.3.2 AFTER WASHING, FINS SHOULD BE SORTED INTO SETS

Sharks balance on their pectoral fins and use their dorsal fins for stabilisation, instead of using their fins for propulsion like bony fish. For this reason, shark fins are different from other fish and consist of soft collagen and elastin fibres in thick skin. The fibres are used to make shark-fin soup and are called fin needles or fin rays. Shark fins are graded by the quality and quantity of fin needle yield. This in turn depends on their colour, size, variety and processed quality.

There exists wide variation in the content of rays in the fins from different body parts, the caudal fins containing the least. Yield of processed fin rays varies depending on size and type of fin used and type of final product. Fins from "black" varieties of sharks contain rays interspaced with considerable quantity of cartilage whereas in the "white" variety, the structure is constituted by rays and gelatinous material with low cartilage content. In the caudal fin, though massive in appearance, only the lower lobe contains rays. The upper or anterior caudal fins contain only few small sized rays which are difficult to separate.

Some sharks such as the nurse shark (Ginglymostoms cirratum) have few fibres and are not suitable for making shark-fin soup, and are consequently not marketable. Other species such as the saw shark (Pristiphorus nudipinnis) may have poor fibres in the pectoral fins, and these may be discarded. It is important to determine which fins can be marketed by species.

Fins from sharks of appropriate size should be collected whole and together in complete sets, generally consisting of two pectoral fins, the first (rarely also the second) dorsal fin and the lower lobe of the tail fin. In order to keep a set together they can be tied with a string to they will not be mixed with the fins from other sharks. This is done by piercing a hole and threading a string through the top part of each fin and keeping them in place with a knot. If fins are sold in bulk, the normal proportion of fins should normally be: Pectoral fins 50%, Dorsal fins 25%, and Caudal fins 25%.

Depending on the market, the second dorsal, ventral and anal fins and the fins from small sharks can also be utilized as mixed fins.

4.6.3.4 THE FINS SHOULD BE CHILLED QUICKLY TO THE TEMPERATURE OF MELTING ICE AND MAINTAINED IN A CHILLED CONDITION UNTIL THEY REACH THE PROCESSOR OR THE MARKET

If the fins are to be sold or processed within a few days, they can be stowed in ice.

4.6.3.5 WHERE CIRCUMSTANCES REQUIRE AND FACILITIES PERMIT, FINS SHOULD BE FROZEN IMMEDIATELY

Optimum quality can be maintained by immediate freezing after washing the fins. This can be accomplished on board properly designed vessels.

4.6.3.6 WHERE CIRCUMSTANCES REQUIRE AND FACILITIES AND WEATHER PERMIT, FINS CAN BE DRIED ON BOARD

Where circumstances do not permit wet fins to be sold quickly or processed immediately or frozen, they can be dried on board, weather permitting. They should be placed on mats and turned from time to time, or hung from the rigging by the set strings. In all events, they need to be protected from rain.

Fins can be either dried directly, or lightly salted before drying by dusting the fins with salt in a ratio of 1:10 (salt to fins), the cut portion being liberally sprinkled with salt. A little lime might also be sprinkled at the cut portion and the fins are set aside for 24 hours. After gently rinsing in clean sea water to remove solid salt and excess lime, the fins may be dried in the sun.

4.6.4 Stowage of Fresh Shark

4.6.4.1 SHARK UNLESS INTENDED FOR SKINNING (FLETCHING) OR FREEZING OR SALTING ON BOARD SHOULD BE CHILLED RAPIDLY IN MELTING ICE OR IN REFRIGERATED SEA WATER OR BRINE AND SHOULD BE STOWED SO THAT THE TEMPERATURE DOES NOT RISE

Temperature is the most important single factor influencing the keeping quality of fresh shark. The effects of increasing temperature are cumulative; that is, some potential keeping time is lost each time the temperature of the shark rises. The extent of this loss depends both on the degree of

rise and the length of time the sharks remain at the higher temperature. It is, therefore, important to chill the catch quickly to the temperature of melting ice and maintain it in a chilled condition until it reaches the processor or the market. (SP 4.4.3.1/Mod)

4.6.4.2 SHARKS SHOULD BE SURROUNDED BY ADEQUATE QUANTITIES OF FINELY DIVIDED ICE

Ice is necessary, not only to cool the sharks, but to maintain them in a cool condition. There should be enough ice to cope with any heat leaking into the fish room. If, at the end of a voyage, sharks are no longer surrounded by ice, then insufficient ice has been used. It is difficult to lay down precise quantities required, but icing should be heaviest against ship's sides and bulkheads. In warm waters it will be necessary to use more ice than in colder climates, and this will also depend on whether the hold is insulated. The correct quantities of ice require to be worked out for individual vessels by trial and error. Finely divided ice gives close contact with the shark, reduces damage by crushing and gives rapid cooling. (SP 4.4.3.3/4.4.3.4)

4.6.4.3 A STOWAGE PLAN SHOULD BE KEPT ON ANY VESSEL FISHING FOR MORE THAN A DAY OR TWO

A well prepared stowage plan enables the various day's catches to be kept separate when unloading. (SP 4.4.3.6/Mod)

4.6.4.4 IF REFRIGERATED SEA WATER OR BRINE IS USED FOR CHILLING OR STOWING OF FRESH SHARK, CHILLING SHOULD BE RAPID AND THE SYSTEM SHOULD BE CAPABLE OF MAINTAINING THE SHARK AT -1 DEG. C. (30 DEG. F)

For the stowage and transportation of shark, it is strongly recommended that the method should be well researched under local conditions and with local species. (SP 4.4.3.7/Mod)

4.6.5 Salting and Fletching

4.6.5.1 PROCESSING AND HANDLING OF SHARK PRIOR TO AND DURING THE SALT CURING OPERATION SHOULD FOLLOW THE PROCEDURES OUTLINED FOR THE PLANT PROCESSING SALTED SHARK ON SHORE

Salting of shark on board fishing vessels is usually done for the purpose of preservation and, therefore, should be regarded as an initial phase of the salt curing process. Nevertheless, the fishermen should follow strictly all technological and hygienic requirements of the onshore processing establishment. (See sub-section 5.4 Operating Practice and Production Requirements). (SA 4.4.1.10)

4.6.5.2 WHEN SHARK IS SPLIT AND DRY-SALTED IN BULK ON BOARD A VESSEL, THE PILE SHOULD BE CHECKED AFTER SOME DAYS TO ENSURE THAT CURING CONDITIONS ARE UNIFORM

Dry-salting in bulk on board the vessel involves a very large quantity of fish piled for long periods before unloading. Since the quality of the salted product depends on the way the

shark is salted, it is useful to ensure that the salt is present in the right amount and that it is uniformly distributed. Further, the pile should be properly arranged to provide adequate drainage. An extra heavy portion of salt is put on where the fish comes into contact with partitions or the sides of the vessels and precautions are taken to ensure the resulting brine is removed. (SA 4.4.1.12)

4.6.5.3 PROCESSING AND HANDLING OF SHARK PRIOR TO AND DURING FLETCHING SHOULD FOLLOW THE PROCEDURES OUTLINED FOR THE PLANT FLETCHING SHARK

Fishermen should follow strictly all technological and hygienic requirements on the onshore processing establishment. (See sub-section 5.4 Operating Practices and Production Requirements). Sharks can neither be gutted or iced before skinning, and should not be frozen. The stomach area is the most valuable part of the hide, and fresh water and ice can cause discolouration. Freezing will also lower quality but to what extent in different species is not known. As fresh water will discolour the hide, all washing operations should be carried out with clean sea water.

4.6.5.4 WHEN HIDES ARE REMOVED, CARCASSES SHOULD BE ICED OR FROZEN

The quality of the meat will depend on the number of sharks to be skinned and the time which elapses until ice or refrigeration facilities are available.

4.6.5.5 ONLY SHARKS SUITABLE FOR HIDES SHOULD BE FLAYED

As previously mentioned, the skin of most large mature female sharks is damaged by wounds and scars inflicted on them by male sharks when mating. Such hides are considerably decreased in value or are not worth tanning at all. Market requirements also determine the size of the shark, so that generally only sharks of 1.5 m. upward in length are normally flayed, smaller specimens being used for meat only.

4.6.6 Food Additives

4.6.6.1 IF FOOD ADDITIVES ARE TO BE USED THE ADVICE OF A FOOD TECHNOLOGIST SHOULD BE SOUGHT AND THE APPROVAL OF THE OFFICIAL AGENCY HAVING JURISDICTION SHOULD BE OBTAINED

Food additives cannot be used indiscriminately. Some are effective only with certain types of food, and in all cases the concentration and the time of contact of the additive must be rigidly controlled in accordance with specialist advice and the official agency having jurisdiction. Food laws differ from one country to another and it is essential to seek specialist advice before using a particular additive, whether the product is for domestic use or for export. (SP 4.4.5.1/Mod)

4.7 Hygiene Control Programme

4.7.1 IT IS DESIRABLE THAT EACH FISHING VESSEL SHOULD DEVELOP ITS OWN SANITARY CONTROL PROGRAMME BY INVOLVING THE

WHOLE CREW AND BY ASSIGNING TO EACH MEMBER A DEFINITE TASK IN CLEANING AND DISINFECTING THE BOAT

A permanent cleaning and disinfection schedule should be drawn up to ensure that all parts of the boat and equipment thereon are cleaned appropriately and regularly.

Fishermen should be properly trained in the use of special cleaning tools, methods of dismantling equipment for cleaning, and should be knowledgeable of the significance of contamination and the hazards involved. (LB 4.7.1)

HANDLING OF SHARK ON SHORE

Section 5 - PLANT FACILITIES AND OPERATING REQUIREMENTS

5.1 Plant Construction and Layout

5.1.1 General Considerations

5.1.1.1 SHARK PROCESSING PLANTS SHOULD BE DESIGNED FOR THE PURPOSE

If a considerable portion of the shark landings is intended to be used for fresh and frozen meat, the most economic solution appears to be processing the sharks in existing fish processing plants. A separate processing line for sharks can be established if required. This arrangement is especially useful if small sharks are being processed and if existing refrigeration facilities can be used. Large sharks are usually difficult to handle in fish processing plants and separate arrangements for skinning would be needed.

Shark meat spoils even more rapidly than fish, because of the high urea content. It is therefore essential that the processing is carried out rapidly in a plant designed to quickly handle sharks and that no build-up of part-processed products occurs.

An establishment utilizing all parts of the shark needs to be equipped for the production of fresh, frozen, smoked and salted/dried shark meat and the production of liver oil, shark fins, shark hides and shark meal. Meat and hide production need to be separated.

5.1.1.2 SHARK PROCESSING PLANTS SHOULD BE DESIGNED AND EQUIPPED SO THAT ALL HANDLING AND PROCESSING OPERATIONS CAN BE CARRIED OUT EFFICIENTLY, AND ALL MATERIALS AND PRODUCTS CAN PASS FROM ONE STAGE OF PROCESSING TO THE NEXT IN AN ORDERLY MANNER AND WITH MINIMUM DELAY

A great deal of care should be taken in planning the layout and equipment of a shark processing plant to ensure that there is sufficient space and suitable facilities to carry out each operation efficiently with due concern for hygiene and quality of the final product and to move sharks and materials through the various stages in an orderly manner.

In order to prevent cross-contamination between different activities and safeguard the wholesomeness and quality of shark and its products, the following operations should be conducted in separate rooms or in well defined areas of adequate size:

(a) receiving and storage of raw materials;
(b) processing fresh and frozen meat;
(c) processing salted or dried products;
(d) fletching of larger sharks and preparation of hides;
(e) drying;
(f) smoking and cooling;
(g) packaging;
(h) oil; and
(i) waste utilization.

The handling of sharks and storage areas should be entirely divorced from:

(a) storage of waste materials;
(b) storage of packaging materials;
(c) storage of cleaning and disinfecting compounds; and
(d) storage of wood and wood products used in the smoking or drying process.

All other areas where sharks or their products are kept for human consumption should comply with the building and sanitary requirements stated for shark handling and processing areas. Adequate chill room facilities should be provided for brining, pickling or dry-salting of sharks if the ambient temperature necessitates it. (SM 4.1.1.1/Mod)

5.1.1.3 THE ECONOMICS OF SHARK PROCESSING SHOULD BE CAREFULLY DETERMINED

Any intensive large shark fishery will be faced with the biological fact that sharks do not lay thousands or millions of eggs as many other bony fish do. Most bear live young after a gestation period ranging from about six months up to two years. Others lay a small number of eggs. Sharks do not grow very fast but do live for the long time. The stocks, therefore, are vulnerable to intensive fishing pressure. Any processing plant based only on shark needs a thorough study of local conditions, stock potential and catching capacity.

5.1.2 Plant Construction and Sanitary Design

5.1.2.1 THE PLANT AND SURROUNDING AREA SHOULD BE SUCH AS CAN BE KEPT REASONABLY FREE FROM OBJECTIONABLE ODOURS, SMOKE, DUST OR OTHER CONTAMINATION. THE BUILDINGS SHOULD BE SUFFICIENT IN SIZE WITHOUT CROWDING OF EQUIPMENT OR PERSONNEL, WELL CONSTRUCTED AND KEPT IN GOOD REPAIR. THEY SHOULD BE OF SUCH DESIGN AND CONSTRUCTION TO PROTECT AGAINST THE ENTRANCE AND HARBOURING OF INSECTS, BIRDS OR OTHER VERMIN, AND TO PERMIT READY AND ADEQUATE CLEANING

The location of a shark processing establishment, its design, layout, construction and equipment should be planned in detail with considerable emphasis on the hygienic aspects, sanitary facilities and quality control.

National or local authorities should always be consulted in regard to building codes, hygienic requirements of the operation and sanitary disposal of sewage and plant waste.

Prior to construction of a new plant or modification of the existing one, a proper flow pattern of operation should be considered. Only a well organized work flow could ensure the maximum efficiency of the operation and the better quality product.

The food handling area should be completely separate from any part of the premises used as living quarters. (MF 4.1.2.1)

5.1.2.2 FLOORS SHOULD BE HARD SURFACED, NON-ABSORBENT AND ADEQUATELY DRAINED

Floors should be constructed of durable, waterproof, non-toxic, non-absorbent material which is easy to clean and disinfect. They should be non-slip and without crevices and should slope evenly and sufficiently for liquids to drain off to trapped outlets fitted with a removable grill.

If floors are ribbed or grooved to facilitate traction, any grooving of this nature should always run towards the drainage channel.

The junctions between the floors and walls should be impervious to water and should be coved or rounded for ease of cleaning.

Concrete, of not properly finished, is porous and can be affected by animal oils, strong brines, various detergents and disinfectants. If used, it should be dense, of a good quality, and with a well finished waterproof surface. (MF 4.1.2.2)

5.1.2.3 DRAINS SHOULD BE OF AN ADEQUATE SIZE, SUITABLE TYPE, EQUIPPED WITH TRAPS AND WITH REMOVABLE GRATING TO PERMIT CLEANING

Suitable and adequate drainage facilities are essential for removal of liquid or semi-liquid wastes from the plant. There should not be any floor area where water might collect in stagnant pools. Drains should be constructed of smooth and impervious materials and should be designed to cope with the maximum flow of liquid without any overflowing and flooding. Each drainage inlet should be provided with a deep seal trap which is appropriately located and easy to clean.

Drainage lines carrying waste effluent except for open drains, should be properly vented, have a minimum internal diameter of 10 cm (4 inches) and, if required, run to a catch basin for removal of solid waste material. Such a basin should be located outside the processing area and should be constructed

of waterproof concrete or other similar material, designed to the local specifications and should meet the requirements of the official agency having jurisdiction. (MF 4.1.2.3)

5.1.2.4 INTERNAL WALLS SHOULD BE SMOOTH, WATERPROOF, RESISTANT TO FRACTURE, LIGHT COLOURED AND READILY CLEANABLE

Acceptable materials for finishing walls inside are cement render, ceramic tiles of an industrial type, various kinds of corrosion-resistant metallic sheeting such as stainless steel or aluminium alloys and a variety of non-metallic sheetings which have adequate impact resistance, desirable surface qualities and are easily repairable.

All sheeting joints should be welded or else sealed with a mastic or other compound resistant to hot water and mould growth, and cover strips should be applied where necessary.

Wall-to-wall junctions should be coved or rounded to facilitate cleaning.

Walls should be free from projections and all pipes and cables should be sunk flush with the wall surface, neatly boxed in a sealed to the wall or neatly boxed in adequately high above floor level, e.g., 1.5 m and mounted from the wall to allow for adequate cleaning and prevention of insect harbourage. (MF 4.1.-2.4)

5.1.2.5 WINDOW SILLS SHOULD BE KEPT TO A MINIMUM SIZE, BE SLOPED INWARD AT LEAST 45 DEGREES AND BE AT LEAST ONE METRE FROM THE FLOOR

Window sills and frames should be made of a smooth, waterproof material and, if of wood, should be kept well painted. Internal window sills should be sloped to prevent storage of miscellaneous materials or accumulation of dust and should be constructed to facilitate cleaning.

Windows should be filled with whole panes and those which open should be screened. The screens should be constructed so as to be easily removable for cleaning and should be made from suitable corrosion-resistant material. (MF 4.1.2.5)

5.1.2.6 ALL DOORS THROUGH WHICH SHARKS OR THEIR PRODUCTS ARE MOVED SHOULD BE SUFFICIENTLY WIDE, WELL CONSTRUCTED OF A SUITABLE MATERIAL AND SHOULD BE OF A SELF-CLOSING TYPE

Doors through which shark or their products are moved should be either of a corrosion-resistant metal, or covered with a corrosion-resistant metal or made from a suitable material with adequate impact resistance and, unless provided with an effective air screen, should be of self-closing type.

Doors and frames of the doorways should have a smooth and readily cleanable surface.

Doors through which the product is not moved, such as those providing staff access, should be appropriately surfaced,

at least on the processing area side, to allow for ease of cleaning. (MF 4.1.2.6)

5.1.2.7 CEILINGS SHOULD BE SO DESIGNED, CONSTRUCTED AND FINISHED AS TO PREVENT ACCUMULATION OF DIRT AND MINIMIZE CONDENSATION, MOULD DEVELOPMENT AND FLAKING AND SHOULD BE EASY TO CLEAN

Ceilings should preferably be a minimum of 3 metres from the floor in height, free from cracks and open joints and should be of a smooth, waterproof, light coloured finish, which does not permit growth of mould.

In buildings where beams, trusses, pipes or other structural elements are exposed, the fitting of a suspended ceiling just below is desirable.

Where the roof beams and trusses cannot be covered, the underside of the roof may constitute a satisfactory ceiling providing all joints are sealed and the supporting structures are of a smooth, well painted light coloured surface, easily cleanable and constructed to protect the fish products from falling debris and dust. (MF 4.1.2.7)

5.1.2.8 PREMISES SHOULD BE WELL VENTILATED TO PREVENT EXCESSIVE HEAT, CONDENSATION AND CONTAMINATION WITH OBNOXIOUS ODOURS, DUST, VAPOUR OR SMOKE

Special attention should be given to the venting of areas and equipment producing excessive heat, steam, obnoxious fumes, vapours or contaminating aerosols. The air-flow in the premises should be from the more hygienic areas to the less hygienic areas. Good ventilation is important to prevent condensation and growth of moulds in overhead structures. Ventilation openings should be screened and, if required, equipped with proper air filters. Windows which open for ventilation purposes should be screened. The screens should be made easily removable for cleaning and should be made from suitable corrosion-resistant material. (MF 4.1.2.8)

5.1.2.9 A MINIMUM ILLUMINATION OF 220 LUX (20 FOOT CANDLES) IN GENERAL WORKING AREAS AND NOT LESS THAN 540 LUX (50 FOOT CANDLES) AT POINTS REQUIRING CLOSE EXAMINATION OF THE PRODUCT SHOULD BE PROVIDED AND SHOULD NOT ALTER COLOURS

Light bulbs and fixtures suspended over the working areas where shark are handled in any step of preparation should be of the safety type or otherwise protected to prevent contamination in case of breakage. (MF 4.1.2.9)

5.1.2.10 SEPARATE AND ADEQUATE STORAGE SHOULD BE PROVIDED FOR WOOD, SAWDUST OR SIMILAR MATERIALS USED IN SMOKING OF SHARK

Wood, wood shavings or sawdust should be stored in a separate storage room or building away from the shark processing areas and in such a manner that there is no contamination by dust or other foreign matter.

To prevent spontaneous heating and the growth of moulds, the wood shavings and sawdust should be sufficiently dry on delivery and should not be stored in large containers, heaps or silos. Storage in bags is advantageous as it allows better aeration, drying and more convenient handling. (SM 4.1.2.10)

5.1.2.11 SEPARATE AND ADEQUATE FACILITIES SHOULD BE PROVIDED FOR DRYING SHARK

Drying should not be done on the ground but on raised, preferably sloping, drying racks or on raised hooks or poles. Air will pass under as well as over the product on racks and therefore the shark will dry more quickly, and more hygienically. If the racks are sloping excess moisture can drain away thus eliminating pockets of water that can form in the gut and gill cavities causing slow drying in these areas. Also, they are more easily protected from rain; product on the ground can be covered from the rain but not from ground water.

All drying racks should be situated in areas with low humidity and with good prevailing winds. Ideally, the ground under the drying racks should be of smooth-capped concrete to facilitate cleaning and eliminate an important breeding ground for flies, otherwise the ground beneath them should be clean and dry. Handling can be minimized by transporting and drying shark and its products in trays and transporting the trays on trolleys (with large wheels). The trays would rest on simple racks about 0.5m above the ground but concrete paths would have to be laid in the drying yard or the soil of the gangway would have to be stabilized e.g., with wire mesh or with sand.

Facilities for shading curing shark and protecting them from rain are also necessary, as well as for storage at night when humidity rises. Where it is necessary to dry in the shade (shark hides), the cover must be built high enough above the product to avoid trapping water vapour; that would prolong the period required for drying and introduce the risk of putrefaction. Even under cover, the drying space must still be well aired.

5.1.3 Hygienic facilities

5.1.3.1 AREAS WHERE SHARK ARE RECEIVED OR STORED SHOULD BE SO SEPARATED FROM AREAS IN WHICH FINAL PRODUCT PREPARATION OR PACKAGING IS CONDUCTED AS TO PREVENT CONTAMINATION OF THE FINISHED PRODUCT

Well defined areas of adequate size, preferable separate rooms, should be provided: (i) for receiving and storing raw materials; and (ii) for operations like heading and gutting shark, washing, skinning, filleting, salting, smoking, or other processing and packaging.

Manufacture or handling of edible products should be entirely separate and distinct from the areas used for inedible materials.

Receiving and storage areas should be clean and readily capable of being maintained in a clean condition and should pro-

vide protection for the raw shark from deterioration and contamination. (MF 4.1.3.1/Mod)

5.1.3.2 A SEPARATE REFUSE ROOM OR OTHER EQUALLY ADEQUATE OFFAL STORAGE FACILITIES SHOULD BE PROVIDED ON THE PREMISES

If offal or other refuse is to be collected and held before removal, adequate precautions should be taken to protect it against rodents, birds, insects and exposure to warm temperatures.

A separate refuse room for storing waste in water-tight containers or offal bins should be provided. The walls, floor and ceilings of such a storage room, and the area under the elevated bins should be constructed of impervious material which can be readily cleaned.

Where waste material is held in containers outside the establishment, the containers should be lidded. A separate enclosure should be provided for their storage with easy access for vehicles loading and unloading. Stands for the containers should be of solid, hard and impervious material which can be easily cleaned and properly drained.

Refuse rooms or other offal storage facilities should be cleaned and disinfected regularly.

If containers are used in large numbers, a mechanical washing plant might be advisable to provide for routine washing. Containers should be capable of withstanding repeated exposure to normal cleaning processes. (MF 4.1.3.2)

5.1.3.3 AN AMPLE SUPPLY OF COLD AND HOT POTABLE WATER AND/OR CLEAN SEA WATER UNDER ADEQUATE PRESSURE SHOULD BE AVAILABLE AT NUMEROUS POINTS THROUGHOUT THE PREMISES AT ALL TIMES DURING THE WORKING HOURS

All water available for use in those parts of establishments where shark is received, held, processed, packaged and stored should be potable water or clean sea water and should be supplied at a pressure of no less than 1.4 kg/cm sq. (20 lb/in sq.).

Water used for washing or conveying raw materials should not be recirculated unless it is restored to a potable level of quality. (MF 4.1.3.4)

5.1.3.5 WHEN INPLANT CHLORINATION OF WATER IS USED THE RESIDUAL CONTENT OF FREE CHLORINE SHOULD BE MAINTAINED AT NO MORE THAN THE MINIMUM EFFECTIVE LEVEL FOR THE USE INTENDED

The cold water supply used for cleaning purposes should be fitted with an in-line chlorination system allowing the residual chlorine content of the water to be varied at will in order to reduce the number of micro-organisms and prevent the build-up of shark odours.

Chlorination systems should not be relied upon to solve all hygiene problems. The indiscriminate use of chlorine cannot

compensate for unhygienic conditions in a processing plant. (MF 4.1.3.5)

5.1.3.6 ICE SHOULD BE MADE FROM POTABLE WATER OR CLEAN SEA WATER AND SHOULD BE MANUFACTURED, HANDLED AND STORED SO AS TO PROTECT IT FROM CONTAMINATION

Ice used in the operation of the shark processing establishment should be made from potable water or clean sea water.

A special room, or other suitable storage facilities, should be provided to protect the ice from contamination and excessive meltage. Dust, flakes of paint, bits of wood or sawdust, straw and rust are the most frequent contaminants transferrable by ice into the final product. Foot traffic should be kept to a minimum.

Care must be taken to ensure that ice used to chill sharks or their products does not contaminate them. (MF 4.1.3.6)

5.1.3.7 PROPER FACILITIES FOR WASHING AND DISINFECTION OF EQUIPMENT SHOULD BE PROVIDED

Facilities should be present in every shark processing establishment for cleaning and disinfection of trays, removable cutting or filleting boards, containers and other similar equipment and working implements. Such facilities should be located in separate rooms or in designated areas in the work rooms where there is an adequate supply of hot and cold potable water or clean sea water, under good pressure, and where there is proper drainage.

Containers and equipment used for offal or contaminated materials should be washed in a separate area to that used for products intended for human consumption. (MF 4.1.3.9)

5.1.3.10 ADEQUATE AND CONVENIENTLY LOCATED TOILET FACILITIES SHOULD BE PROVIDED

Toilet rooms should have walls and ceilings of a smooth, washable, light coloured surface and floors constructed of impervious and readily cleanable material. Toilet facilities should be well lit, ventilated and kept in a hygienic condition at all times. An adequate supply of toilet paper should be available in each toilet cubicle. The doors leading to the facilities should be of a self-closing type and should not open directly into the shark processing area.

Hand washing facilities of a type not requiring operation by hand with an adequate supply of warm or hot and cold water or clean sea water, with liquid or powdered soap and with a suitable and hygienic means of drying hands, should be provided adjacent to the toilets and in such a position that the employee must pass them when returning to the processing area. Where hot and cold water are available mixing taps should be provided. Where paper towels are used, a sufficient number of dispensers and receptacles should be provided near to each washing facility.

The following formula could be used in assessing the adequacy of toilet facilities in relation to the number of employees present at any one time:

1 to 9 employees	= 1 toilet
10 to 24 employees	= 2 toilets
25 to 49 employees	= 3 toilets
50 to 100 employees	= 5 toilets

Note: Urinals may be substituted for toilets, but only to the extent of one-third of the total toilets required. (MF 4.1.3.10)

5.1.3.9 FACILITIES SHOULD BE AVAILABLE IN THE PROCESSING AREAS FOR EMPLOYEES TO WASH AND DRY THEIR HANDS AND FOR DISINFECTION OF PROTECTIVE HAND COVERINGS

In addition to hand washing facilities available in toilet rooms, a number of washbasins with an adequate supply of hot and cold potable water or clean sea water and appropriate liquid or powdered soap should be provided whenever the process demands. They should be located at all employee entrances in full view of the processing floor and should be of a type not requiring operation by hand or be fed by a continuous flow of potable water or clean sea water. Single use towels are recommended; otherwise the method of drying hands should meet the requirements of the official agency having jurisdiction. In case single use paper towels are provided a sufficient number of dispensers as well as receptacles for used towels should be available. The facilities should be kept in a hygienic condition at all times. (MF 4.1.3.11)

5.1.3.10 STAFF AMENITIES OF LUNCHROOMS AND CHANGING ROOMS OR ROOMS CONTAINING SHOWER OR WASHING FACILITIES SHOULD BE PROVIDED

Where workers of both sexes are employed, separate facilities should be present for each except that the lunchrooms may be shared. As a general guide, the lunchrooms should provide seating accommodation for all employees and the changing rooms should provide enough space for lockers or some alternative facilities for each employee without causing undue congestion. Clothing and footwear not worn during working hours must not be kept in any processing area. (MF 4.1.3.12)

5.1.3.11 SALT AND OTHER INGREDIENTS USED IN THE CURING OR PROCESSING OF SHARK OR SHARK PRODUCTS SHOULD BE STORED WHERE APPROPRIATE IN A DRY STATE AND IN A MANNER TO PREVENT THEIR CONTAMINATION

If salt is kept in a moist environment the moisture absorbed tends to bring about a modification in the crystallization of the salt. The crystals form a crust on the surface of the piles of salt which may sometimes cake, forming a solid mass that becomes difficult to handle and therefore may result in less uniformly salted product. (SA 5.1.3.11/Mod)

5.1.3.12 STORAGE FACILITIES SHOULD BE AVAILABLE FOR THE PROPER DRY STORAGE OF PACKAGING MATERIALS

Separate facilities for the storage of cartons, wrappings or other packaging materials should be provided in order to protect them against moisture, dust or other contamination. (MF 4.1.3.14)

5.1.3.13 IF POISONOUS OR HARMFUL MATERIALS, INCLUDING CLEANING COMPOUNDS, DISINFECTANTS AND PESTICIDES ARE STORED, THEY SHOULD BE KEPT IN A SEPARATE ROOM DESIGNED OR MARKED SPECIFICALLY FOR THIS PURPOSE

All such materials must be prominently and distinctly labelled so that they can be easily identified. The room should be kept locked and the materials contained in it should be handled only by personnel trained in their use (MF 4.1.3.5)

5.2 Equipment, Utensils and Working Surfaces

5.2.1 ALL WORKING SURFACES, EQUIPMENT AND UTENSILS USED IN FOOD HANDLINE AREAS AND WHICH MAY CONTACT FOOD SHOULD BE MADE OF MATERIAL WHICH DOES NOT TRANSMIT TOXIC SUBSTANCES, ODOURS OR TASTES, IS NON-ABSORBENT, IS RESISTANT TO CORROSION AND IS CAPABLE OF WITHSTANDING REPEATED CLEANING AND DISINFECTION. SURFACES SHOULD BE SMOOTH AND FREE FROM PITS AND CREVICES. THE USE OF WOOD AND OTHER MATERIALS WHICH CANNOT BE ADEQUATELY CLEANED AND DISINFECTED SHOULD BE AVOIDED EXCEPT WHEN THEIR USE WOULD CLEARLY NOT BE A SOURCE OF CONTAMINATION. THE USE OF DIFFERENT MATERIALS IN SUCH A WAY THAT CONTACT CORROSION CAN OCCUR SHOULD BE AVOIDED

Contamination of shark during processing can be caused by contact with unsatisfactory surfaces. All food contact surfaces should be smooth, free from pits, crevices and loose scale, substances harmful to health, unaffected by salt, shark juices or other ingredients used, and capable of withstanding repeated cleaning and disinfection. If in the absence of other materials wood has to be used, a single board of a well finished and smooth surface is recommended. Once the surface becomes badly worn or pitted, then the board should be reconditioned or discarded. The use of plywood or other boards of laminated structure should be discouraged.

Machines and equipment should be so designed that they can be easily dismantled to facilitate thorough cleaning and disinfection.

Containers used for holding raw material should preferably be constructed of plastic or corrosion-resistant metal and, if of wood, they should be treated to prevent the entry of moisture and coated with a durable non-toxic paint or other surface coating that is smooth and readily washable. Any container, the surface of which is pitted, corroded or scaled should not be used for holding fishery products. Wicker baskets should not be used.

Stationary equipment should be installed in such a manner as will permit easy access and thorough cleaning and disinfection.

Tables should be so constructed that there will be no inaccessible points which may be omitted in establishment clean-up. Stands for workers along the processing lines should be constructed of metal, should be well maintained and should be movable or so constructed that the stands and the floor beneath can be properly cleaned.

Equipment and utensils used for inedible or contaminated materials should be identified as such and should not be used for handling of shark and shark products intended for human consumption. (MF 4.2.1/Mod.)

5.2.2 BRINING AND SALTING VATS SHOULD BE MADE OF SUITABLE CORROSION-RESISTANT MATERIAL AND SHOULD BE SO CONSTRUCTED AS TO PERMIT EASY CLEANING AND COMPLETE DRAINAGE

Such vats or containers could become a serious source of contamination by micro-organisms, rust, dirt and miscellaneous debris if not made of suitable material or if not kept clean. (SA 5.2.3)

5.2.3 SMOKING OR DRYING KILNS, TRADITIONAL OR MECHANICAL, SHOULD BE ADEQUATE FOR THE INTENDED PRODUCTION, DESIGNED BY AN EXPERT AND CONSTRUCTED BY CRAFTSMEN COMPETENT AND EXPERIENCED IN THIS FIELD

Both types of kilns, traditional and mechanical, should be preferably designed and constructed by specialists to ensure safe and efficient operation and to facilitate easy cleaning. The use of automated smoke generators is strongly recommended, and instrumentation to monitor and control the smoking process should be applied wherever possible. These and other requirements for smoking can be found in the "Recommended International Code of Practice for Smoked Fish" (CAC/RCP 25-1979)

5.2.4 EQUIPMENT USED FOR HANGING OR LAYING OUT OF SHARKS DURING SMOKING SHOULD BE CONSTRUCTED OF SUITABLE CORROSION-RESISTANT MATERIAL AND SHOULD BE DESIGNED SO AS TO BE READILY CLEANABLE

Trolleys, racks and other equipment which do not come in direct contact with shark, should be constructed to permit easy and thorough cleaning. (SF 4.2.2.4)

5.2.5 EQUIPMENT USED FOR HANGING OR LAYING OUT OF SHARKS OR THEIR PRODUCTS DURING DRYING SHOULD BE DESIGNED SO AS TO BE READILY CLEANABLE

Wire racks if not constructed of suitable corrosion-resistant material should be replaced as needed. Racks and trays should be constructed to permit easy and thorough cleaning. Trolleys and other equipment which do not come in direct contact with shark should also be constructed to permit easy and thorough cleaning.

5.2.6 REFRIGERATION AND FREEZING EQUIPMENT SHOULD BE PROPERLY DESIGNED AND CONSTRUCTED AND SHOULD BE OF ADEQUATE CAPACITY

The freezing equipment should be designed and operated in accordance with the requirements stated in the "Recommended International Code of Practice for Frozen Fish" (CAC/RCP 16-1978). (CB 5.2.8)

5.3 Hygienic Operating Requirements

5.3.1 GENERAL HYGIENE IN AN ESTABLISHMENT WHERE SHARK IS PROCESSED FOR HUMAN CONSUMPTION SHOULD BE OF A HIGH STANDARD AND ALL HANDLING AND PROCESSING OPERATIONS INVOLVED IN THE PREPARATION AND DISTRIBUTION OF SHARK SHOULD BE CARRIED OUT UNDER HYGIENIC CONDITIONS

Shark, because of its highly perishable nature, requires strict adherence to specific hygienic requirements which should become a part of a daily operational routine of the plant. All operations should be carried out in a manner and condition suitable for handling of food for human consumption. (MF 4.3.1/4.-3.6/Mod)

5.3.2 ALL WHARVES, QUAYS, MARKETS AND SIMILAR AREAS WHERE SHARKS ARE UNLOADED OR DISPLAYED FOR SALE, SHOULD BE KEPT CLEAN AND DISINFECTED

Shark, as a food for human consumption, should be treated as such in clean surroundings. Any dirty surfaces in the vicinity of the unloading area involves the risk that shark will be contaminated with filth and micro-organisms of public health significance. (MF 4.3.2)

5.3.3 FILLETING AND CUTTING BOARDS SHOULD BE FREQUENTLY AND THOROUGHLY SCRUBBED AND TREATED WITH DISINFECTANT. WHEREVER PRACTICABLE THE BOARDS SHOULD BE CONTINUOUSLY FLUSHED WITH RUNNING POTABLE WATER OR CLEAN SEA WATER DURING USE

It is recognized that the amount of microbial contamination on fillets and similar products is related to the amount of microbial contamination of the working surfaces. Clean surfaces become contaminated as soon as they are used, and consequently each shark that is filleted, after the first one, increases the surface contamination. Filleting and cutting surfaces should therefore be cleaned during meal breaks and before resumption of production following other work stoppages. If they are not thoroughly scrubbed and disinfected, at least at the end of each working day, there may be a serious day-to-day carry-over of microbial contamination.

It has been proved that this contamination of both fillets and boards can be considerably reduced by continuous flushing with cold potable water or cold clean sea water. A further reduction in contamination has been observed when using chlorinated water for flushing. Excessive disinfectant is to be avoided because of the danger of tainting the finished product or other harmful effect and the possibility that this may be availed of to disguise malpractices in processing. (MF 4.3.5)

5.3.4 IF BARRELS OR OTHER CONTAINERS ARE USED ON THE CUTTING LINES FOR THE COLLECTION AND DISPOSAL OF OFFAL, THEY

SHOULD BE LOCATED BELOW THE LEVEL AT WHICH THE SHARKS ARE PROCESSED AND IN SUCH A WAY THERE IS NO SPLASH-BACK ON THE PROCESSING LINE

If individual offal containers are used close to a processing line instead of the flumes or chutes connected to a common line, they should be located in such a way that there is not possibility of splash-back. Placement of the filleting boards or the fillet containers on the rims of the offal barrels should not be practised. If the containers are not being used then they should be lidded.

5.3.5 ALL MACHINES USED IN SHARK PROCESSING OPERATIONS SHOULD BE THOROUGHLY CLEANED, DISINFECTED AND RINSED AT SUITABLE INTERVALS AND AT THE END OF OPERATIONS AND BEFORE RESUMPTION OF PRODUCTION FOLLOWING EXTENDED WORK STOPPAGES AND AT OTHER TIMES WHEN NECESSARY

The use of machinery reduces the risk of contamination from human sources. If, however, these machines are not properly maintained and thoroughly cleaned, they can become a serious source of contamination. All trapped or accumulated products in machinery and equipment should be removed periodically throughout the working day. All machinery and equipment should be inspected before processing begins to ensure that they have been properly cleaned, disinfected, rinsed and reassembled. Mechanized or automated equipment should be regularly checked to prevent breakdowns. (MF 4.3.5/Mod.)

5.3.6 THE BUILDING, EQUIPMENT, UTENSILS AND OTHER PHYSICAL FACILITIES OF THE PLANT SHOULD BE KEPT CLEAN, IN GOOD REPAIR AND SHOULD BE MAINTAINED IN AN ORDERLY AND HYGIENIC CONDITION

All surfaces which come into contact with shark should be hosed down with cold potable water or clean sea water as frequently as necessary to ensure cleanliness. It is important that the cleaning method used will remove all residues and the disinfecting method will reduce the microbial population of the surface being cleaned. A preliminary rinse in potable cold water or clean sea water, followed by a wash in water of a sufficient temperature providing for effective cleaning is recommended. An ample supply of potable water or clean sea water at adequate pressure is the first requirement and cleaning will be much easier if done immediately and the surfaces are not allowed to dry.

The use of cold or hot potable water or clean sea water alone is generally not sufficient to accomplish the required result. It is desirable, if not essential, that scrubbing, wherever appropriate, be used to assist in achieving the desired objective. After the application of cleaning and disinfecting agents the surfaces which come into contact with fish should, after an adequate contact time has elapsed, be rinsed thoroughly with cool potable water or cool clean sea water before use.

Cleaning agents and disinfectants used should be appropriate for the purpose and should be so used as to present no

hazard to public health and should meet the requirements of the official agency having jurisdiction.

All cleaning of equipment should be carried out so that this operation does not adversely affect the processing operations and the quality of the finished products. (MF 4.3.9)

5.3.7 UTENSILS AND FOOD-CONTACT SURFACES OF EQUIPMENT SHOULD BE PROTECTED FROM CONTAMINATION

Cleaned and disinfected portable equipment and utensils should be stored above the floor in a clean, dry location. Suitable space and facilities should be provided for such storage so that food-contact surfaces are protected from splash, dust and other contamination.

The same requirement should also apply to the exposed food-contact surfaces of fixed equipment.

Utensils should be air-dried before being stored or should be stored in a self-draining position on hooks or racks constructed of corrosion-resistant material. When the storage in protective liquids or other solutions is practised, the equipment and utensils so stored should subsequently be washed, disinfected and rinsed prior to re-use. Wherever practicable, stored containers and utensils should be covered or inverted. (SF 4.3.6)

5.3.8 REMOVAL OF SOLID, SEMI-SOLID OR LIQUID WASTES FROM SHARK UNLOADING, HOLDING AND PROCESSING AREAS SHOULD BE ON A CONTINUOUS OR NEAR-CONTINUOUS BASIS USING WATER AND/OR APPROPRIATE EQUIPMENT SO THAT THESE AREAS ARE KEPT CLEAN AND THERE IS NO DANGER OF CONTAMINATING THE PRODUCT.

All waste materials resulting from the operation of a shark processing plant should be disposed of as soon as possible in a way that they cannot be used for human food and in a manner that they cannot contaminate food and water supplies and offer harbourage or breeding places for rodents, insects or other vermin.

Containers, flumes, conveyors, bins or storage bays used for removal, collection or storage of shark offal and other waste should be cleaned frequently with potable water or clean sea water containing an appropriate amount of free chlorine or other suitable disinfectant.

All waste material from containers and vehicles should be removed in such a way as not to cause any contamination and not to create a nuisance. Arrangements for the frequent removal and disposal of waste material should be approved by the appropriate official agency having jurisdiction. (MF 4.3.10)

5.3.9 EFFECTIVE MEASURES SHOULD BE TAKEN TO PROTECT AGAINST THE ENTRANCE INTO THE PREMISES, ESPECIALLY STORAGE AREAS AND THE HARBOURAGE ON THE PREMISES OF INSECTS, RODENTS, BIRDS OR OTHER VERMIN

An effective and continuous programme for the control of insects, rodents, birds or other vermin within the establishment should be maintained. The plant and surrounding area should be regularly examined for evidence of infestation. Where control measures are necessary, treatment should be under the direct supervision of personnel with a thorough understanding of the hazards involved, including the possibility of harmful residues being retained by the shark, or their products, and the chemical, biological or physical agents used should meet the requirements of the official agency having jurisdiction.

The use of insecticides, during the plant operation, without any provision for collection of dead insects, should be discouraged. Instead, the use of adhesive insect traps or very efficient ultraviolet insect killers with attached collection trays, is recommended. Insect traps and light sources which may attract insects should not be located directly over the processing areas and should be away from windows and doors. Ultraviolet insect killers should be left on overnight with all doors and windows shut.

All rodenticides, fumigants, insecticides or other harmful substances should be approved by the authority having jurisdiction. They should be prominently and distinctly labelled, stored in separate locked rooms or cabinets used only for that purpose, and handled only by properly trained personnel. (MF 4.3.11)

5.3.10 DOGS, CATS AND OTHER ANIMALS SHOULD BE EXCLUDED FROM AREAS WHERE SHARK IS RECEIVED, HANDLED, PROCESSED OR STORED

Dogs, cats and other animals are potential carriers of disease and should not be allowed to enter or to live in rooms or areas where shark or its products are handled, prepared, processed or stored. (MF 4.3.12)

5.3.11 ALL PERSONS WORKING IN A SHARK PROCESSING PLANT SHOULD MAINTAIN A HIGH DEGREE OF PERSONAL CLEANLINESS WHILE ON DUTY AND SHOULD TAKE ALL NECESSARY PRECAUTIONS TO PREVENT THE CONTAMINATION OF SHARK OR ITS PRODUCTS OR INGREDIENTS WITH ANY FOREIGN SUBSTANCE

All employees should wear clean light-coloured protective clothing, appropriate to the nature of their work, including footwear, and a covering for the hair, or for a beard where required, all of which articles are either washable or disposable. The use of waterproof aprons, where appropriate, is recommended. Light colours are required to assess visually the cleanliness of the garment. It is desirable that, except for workers operating in freezers or cold rooms, the sleeves of clothing should not extend below the elbows, unless waterproof protective sleevelets are used to cover the arms.

Gloves used in the handling of fish should be maintained in a sound, clean and hygienic condition and should be made of an impermeable material except where their usage would be incompatible with the work involved. Hands should be washed thoroughly with soap or another cleaning agent and warm water before

commencing work, on every occasion after visiting a toilet, before resuming work and whenever necessary. The wearing of gloves does not exempt the operator from having thoroughly washed hands.

Any behaviour which can potentially contaminate the fish such as eating, smoking, chewing of tobacco or other materials and spitting should be prohibited in any part of the shark handling areas. (MF 4.3.13)

5.3.12 NO PERSON WHO IS KNOWN TO BE SUFFERING FROM, OR WHO IS A CARRIER OF, ANY COMMUNICABLE DISEASE OR HAS AN INFECTED WOUND OR OPEN LESION SHOULD BE ENGAGED IN THE PREPARATION, HANDLING OR TRANSPORTATION OF SHARKS OR SHARK PRODUCTS

The management should take care to ensure that no person, while known or suspected to be suffering from, or to be a carrier of a disease likely to be transmitted through food or while afflicted with infected wounds, skin infections, sores or with diarrhoea, is permitted to work in any food handling area in any capacity in which there is any likelihood of such a person directly or indirectly contaminating food with pathogenic micro-organisms. Any person so affected should immediately report to the management that he is ill.

Any person who has a cut or wound should not continue to handle food or food contact surfaces until the injury is completely protected by a waterproof covering which is firmly secured, and which is conspicuous in colour. Adequate first-aid facilities should be provided for this purposes. (MF 4.3.14)

5.3.13 CONVEYANCES USED FOR TRANSPORTING SHARK SHOULD BE CLEANED AND DISINFECTED IMMEDIATELY AFTER USE AND SHOULD BE SO MAINTAINED AS NOT TO CONSTITUTE A COURSE OF CONTAMINATION FOR THE PRODUCT

The cleaning of vehicles, together with receptacles and equipment thereon, should be planned to a regular routine. Hosing, scrubbing and cleaning with potable water or clean water to which suitable detergents and disinfectants have been added are usually necessary.

Forklift trucks should not be used outside the plant unless they can be adequately cleaned upon re-entry. (MF 4.3.15)

5.3.14 STRICT HYGIENIC PROCEDURES SHOULD BE OBSERVED DURING HANDLING, PROCESSING AND STORAGE OF SMOKED SHARK TO PREVENT PRODUCTION OF TOXIN BY <u>CLOSTRIDIUM BOTULINUM</u>

The micro-organism <u>Clostridium botulinum</u> sometimes occurs in water and bottom sediments and hence may occasionally be found on shark. Given the right conditions, the organism may produce toxin which can cause fatal food poisoning.

Some processes employed in hot smoking are insufficient to inhibit outgrowth and toxin production of <u>Clostridium botulinum</u> type E, and in lightly salted products (less than 5% salt) the outgrowth of this organism will not be prevented.

Where this is the case, effective methods of avoiding the dangers of botulinum poisoning from lightly salted smoked shark are, firstly, the strict observance of hygienic and good manufacturing practices during the handling and processing and, secondly, to keep final product temperature at all times below 3 deg. C. (37 deg. F) at which temperature the organism does not grow. It is therefore advisable that the recommended storage temperature should be clearly stated on the label.

Outgrowth and toxin formation from Clostridium botulinum during hot smoking can be prevented by control of the combination of time and temperature, and the water phase salt concentration of the shark flesh.

No risk is attached to frozen smoked shark provided it remains frozen from the time of production to cooking and/or consumption. Freezing does not destroy the micro-organisms and therefore any mishandling after thawing could result in outgrowth of and toxin production by Clostridium botulinum.

5.3.15 CLEANING OF SMOKING EQUIPMENT SHOULD BE MADE INTO A REGULAR ROUTINE

The periodical removal of tarry deposits on walls, ceilings, fans, tenters, racks, trolleys, etc., is necessary not only for hygienic reasons but also to reduce the risk of fire. (SF 4.3.7/Mod)

5.3.16 BRINE USED IN BRINING OF SHARK SHOULD BE CHANGED AS FREQUENTLY AS NECESSARY TO PREVENT ACCUMULATION OF FATTY SCUM AND DEPOSITION OF SLUDGE OF SOLID SALT MIXED WITH SHARK RESIDUE AND OTHER FOREIGN MATTER

There are always some impurities left in the brine after shark have been removed. These impurities derive mainly from salt or shark and may consist of undissolved salts, particles of dirt, slime and other remnants of shark including fat, blood and proteins. Such impurities should be removed either by changing the brine or re-circulating it through a filtering device.

With every batch, the strength of the brine should be checked with a salinometer (brinometer) and adjusted to the required concentration. (SF 4.3.8/Mod)

5.3.17 DRYING YARDS NEED TO BE MAINTAINED CLEAN

At the end of each day's operation the whole area where sharks or their products have been handled, including all equipment should be cleaned. All fish residues should be gathered together for disposal and not left to serve as breeding grounds for insect pests. If the ground is not smooth-capped concrete, spraying the ground below the drying racks with a contact insecticide will reduce insect attack, but it is important that the insecticide does not contaminate the product and the job is done in accordance with section 5.3.9. Crawling insects may be further reduced by setting drying rack poles in moats of water.

5.4 Operating Practices and Production Requirements

5.4.1 General considerations

5.4.1.1 SHARK AND SHARK PRODUCTS SHOULD BE OF GOOD QUALITY, WELL PREPARED AND PACKAGED SO THAT THEY WILL BE PROTECTED FROM CONTAMINATION AND REMAIN ATTRACTIVE AND SAFE TO EAT

Shark meat is more difficult to handle than fish meat. This is a consequence of biological and physiological differences between fish and shark. The meat of some species tastes somewhat acid, it can smell somewhat strong and all shark meat develops ammonia quickly from its high urea content. This is natural but through proper handling, processing and cooking the development of any repulsive odour and flavour can be avoided. Only sharks which are suitable for human consumption should be processed for food. Despite the masking effect of salt or smoke on taste, odour and colour of sharks, poor quality raw materials will produce poor quality products. A few shark species are not suitable for the production of fresh and frozen meat, and too old shark should strictly be used for other purposes than the production of fresh and frozen meat.

5.4.1.2 SHARK AND SHARK PRODUCTS MAY NEED SPECIAL PROCESSING TO MAKE THEM ACCEPTABLE FOR HUMAN CONSUMPTION

Shark meat is lean and is somewhat acid compared with other fish. As mentioned earlier, a major difference between bony fish and sharks is the utilization of urea. Urea is formed in blood and body fluid of all marine fish, the difference is only that the bony fish excrete urea quickly while sharks retain it in their blood. As a result the blood has a higher osmotic concentration than that of the bony fish and absorbs fresh water through membranes by osmosis. Thus sharks do not drink as a bony fish must. Different shark species have different contents of urea and this content is species-characteristic and varies from about 1 600 mg% (spiny dogfish) to about 2 300 mg% (hammerhead shark). Urea is absolutely harmless but gives the meat a specific smell and a sour-bitter (acid) taste. With the difference in the urea content the intensity of the smell and taste differs. It has been discovered that 1 200 mg% is the threshold value below which are is not detected in shark meat; 1 400 mg% of urea is not noticeable if the meat is prepared with ingredients which give a distinct flavour, e.g., with spices or salt, or when it is fried.

5.4.1.3 FINS NEED BE PREPARED FOR A SPECIALIST MARKET

Fins are the most valuable part of the shark and are one of the most expensive food items in the world. Shark fins are highly regarded by the Chinese ethnic group, rich and poor, and form the basis for a number of favourite Chinese dishes. Chinese cooks use the soft collagen and elastin fibres found uniquely in sharks to make shark-fin soup and other items. These fibres are called fin needles, and the fin traders' main interest is the quality and quantity of fin needle yield within a shark fin. Shark fins are sold in many different forms involving different processing stages, e.g. chilled, frozen, dried, processed fins and prepared needles. Only the preparation of fins is covered in this code.

5.4.1.4 HIDES NEED TO BE PREPARED FOR SPECIAL TANNING

The special feature of sharks is their particular evolution of skin covering. Instead of thin, more or less round scales as the other fish have, sharks are covered with a latticework of placoid scales which bear more of a resemblance to teeth, the so-called dermal dentices or skin teeth. Each denticle consists of a firmly anchored and calcified base from which an enamel capped spine sprouts through the skin pointing towards the tail. These dermal denticles are known as shagreen.

The product originally derived from the treatment of shark hides used to be known as "shagreen" a rough leather used for rasping and polishing. Technological developments of a chemical process which could remove the denticles in a commercially feasible process have enabled tanners to produce beautifully textured leathers with individual grains that are extremely hard wearing, tough and scuff-proof, yet supple enough for the manufacture of small leather items. One process for removing denticles is the following - the hides with adherent salt, are placed in a vat containing 10% hydrochloric acid in a saturated solution of common salt. In from about half an hour for small sharks to about two hours for large ones, most of the denticles dissolve away an those that are still adherent can be scraped off with a scudding or de-hairing knife. The acid in the hides is neutralized in a saturated salt solution with the aid of hydrated lime. The hide is then tanned in ordinary vegetable tanning liquors. It is essential, when using this process for removing the shagreen, that the acid concentration be maintained at a uniform strength and the salt kept in a saturated solution. The temperature should be as near as possible to 23 deg. C (73.4 deg. F).

Boraso-leather is made from the hides of certain small sharks. The denticles are not removed; instead the diamond-shaped cones are polished to a high gloss.

Virtually all hides can be used for leather, however economics need be carefully considered. Small and medium-sized sharks are usually used for meat as meat generally has a higher sales value than small hides. This of course may change considering the proximity of the tannery. Larger sharks of 1.5 m or over, may be used for the production of hides in the first instance as there are ready markets for hides of good quality and the hides may be the key revenue product in the economics of a shark fishery with a great proportion of large sharks. It is unlikely that a sufficiently great number of large sharks can be caught in one area over a long period of time to make hides the main product of any shark fishing enterprise.

5.4.2 Handling of raw material

5.4.2.1 ALL SHARKS OR THEIR PARTS SHOULD BE CAREFULLY INSPECTED, SORTED OR CULLED BEFORE THEY ARE PROCESSED. ANY DAMAGED, CONTAMINATED OR OTHERWISE UNACCEPTABLE SHARKS OR THEIR PARTS SHOULD BE DISCARDED

Upon landing, sharks should be sorted as to utilization - fresh or frozen, salting, skinning and fins for further pro-

cessing. If skinned at sea or on the dock, an inspection must be carried out to determine if the meat is still fit for human consumption. If it is fit, it must be decided which way it will be processed. A few shark species are not suitable for the production of fresh and frozen meat, and too old shark should strictly be used for other purposes than the production of fresh and frozen meat. The quality of the hide must be inspected to see if it is worth skinning.

Processing will reduce some of the natural physiological conditions of the shark, but it cannot correct faults that are due to improper handling practices or prolonged storage. Despite the masking effect of salt or smoke on taste, odour and colour of shark, poor quality raw material will produce poor quality salted and smoked products. Raw materials should not be accepted by the establishment if they are spoiled, rancid, or if they are known to contain harmful or foreign substances which under normal plant procedures of sorting or preparation would not be reduced to an acceptable level. Depending where caught, certain species or size grades may need the approval of an official agency having jurisdiction in order to be processed

5.4.2.2 SALT AND INGREDIENTS USED IN A SHARK PROCESSING ESTABLISHMENT SHOULD BE FREE FROM CONTAMINATION AND OF AN APPROPRIATE QUALITY

Salt and other ingredients used on shark or its products intended for human consumption should be of food grade. All salt and ingredients should be or an appropriate quality and otherwise suitable for the purpose.

5.4.2.3 RAW MATERIALS SHOULD BE HANDLED AND PROCESSED WITH CARE AND WITH A MINIMUM OF DELAY

Special attention should be given to preserve quality at all stages of holding and processing since the yield from the raw material, the length of useful storage life and the final quality of the finished product will be greatly affected. There should be no unnecessary delays between processing operations. It is considered good practice to develop a schedule of permitted times in which each operation will be allocated a portion of a total time permitted for each shark to remain on the premises of the processing plant (MF 4.4.1.1/Mod).

5.4.2.4 RAW MATERIAL SHOULD ALWAYS BE TREATED IN A HYGIENIC MANNER

Evisceration, filleting, skinning and other operations in the handling of shark should be clean and hygienic. Precautions should be taken to protect the sharks from contamination by animals, insects, birds, chemical or microbiological contaminants or other objectionable substances during processing, handling and storage.

Preparatory operations leading to the finished product and the packaging operations should be so timed as to permit expeditious handling or consecutive batches in production within the time and temperature range that will prevent deterioration,

spoilage or the development of micro-organisms of public health significance (MF 4.4.1.2).

5.4.2.5 ADEQUATE FACILITIES SHOULD BE AVAILABLE AT THE PROCESSING PLANT TO MAINTAIN FISH IN A CHILLED OR FROZEN CONDITION

Where supplies or shark cannot be processed on arrival at the factory, adequate facilities are required to keep the sharks cool. It must be noted, however, that where chill rooms are installed, these are not designed to cool the sharks but only to maintain them in this condition after they have been cooled by ice or other means.

It is poor practice, therefore, to load the chill room with large quantities of fresh shark that were not pre-chilled effectively to the temperature of melting ice.

The chill room should be equipped with a recording thermometer and an automatic temperature control, and should be so designed that it could be kept in a clean hygienic condition at all time. The chill room should also be equipped with an automatic alarm system to alert the proper personnel when the temperature drops below 0 degrees C (32 deg. F).

If frozen fish is used as raw material, the incoming material should be stored in a freezer store with sufficient capacity to keep the temperature of the product at -25 deg. C (13 deg. F) or lower so as to maintain products awaiting processing in good condition (MF 4.4.1.3/Mod).

5.4.2.6 SHARK INTENDED FOR FRESH OR FROZEN HUMAN CONSUMPTION SHOULD BE MAINTAINED AS CLOSE AS POSSIBLE TO THE TEMPERATURE OF MELTING ICE THROUGHOUT THE PROCESSING OPERATION

Shark is extremely perishable and should be handled at all time with great care and kept at a temperature as close to melting ice as possible in order to reduce action of micro-organisms and undesirable chemical reactions to preserve keeping time (MF 4.4.1.5/Mod).

5.4.2.7 IF FROZEN SHARK IS USED AS RAW MATERIAL, THE THAWING SHOULD BE DONE IN THE MANNER RECOMMENDED IN THE "RECOMMENDED INTERNATIONAL CODE OF PRACTICE FOR FROZEN FISH" (CAC/RCP 16-1978). IF PROCESSING CANNOT COMMENCE IMMEDIATELY IT SHOULD BE TRANSFERRED TO A CHILLED ENVIRONMENT

When frozen shark has been thawed, it is susceptible to spoilage in the same manner as fresh shark. The rate of spoilage increases as temperature is increased appreciably above that of melting ice. It is important therefore that the temperatures to which the fish are exposed during thawing should be no higher than is necessary to carry out the operation reasonably quickly and that the shark should be either processed or thoroughly chilled as soon as they are thawed. It is generally desirable to commence processing or return the shark to a chilled environment a little before thawing is complete, since the centres will

continue to thaw until the temperatures within the shark have been equalized.

Generally the thawing method chosen should suit the volume and type of product that is to be processed and should be economically practicable. Where fish are thawed in still air, the ambient temperature should not exceed 18 degree C (65 degrees F). With air blast thawing, the air should be humidified and its temperature should not exceed 21 deg. C (70 de. F). Where water is circulated in the thawing tank, adequate precautions should be taken to avoid its becoming contaminated with blood, slime and micro-organisms. The tanks should be drained and thoroughly cleaned at regular intervals.

It should be borne in mind that under similar conditions small sharks will thaw much sooner than large sharks or large shark blocks. Sharks frozen in blocks can therefore be thawed more rapidly if the individual sharks are separated as soon as thawing has proceeded far enough to do so. Where sharks of various sizes are thawed together, care should be taken that the smaller sharks are removed and chilled as soon as they are thawed (MF 4.4.2.2/Mod).

5.4.2.8 WHERE SHARKS INTENDED FOR SKINNING ARE WASHED, THEY MUST BE WASHED WITH SEA WATER

Sea water under pressure is required for washing sharks intended for skinning as fresh water would spoil the skin of the sharks.

5.4.2.9 WHERE SHARKS ARE BEING PROCESSED, THESE OPERATIONS SHOULD BE CARRIED OUT IN A CLEAN AND HYGIENIC MANNER

All waste material resulting from these operations should be collected immediately into suitable containers which are removed and emptied regularly or be removed continuously by mechanical means or flumes (SF 4.4.2.5/Mod).

5.4.3 Preparing fresh and frozen meat

5.4.3.1 ALL SHARKS SHOULD BE THOROUGHLY DE-ICED AND WASHED BEFORE PROCESSING AND WASHED IMMEDIATELY AFTER OPERATIONS LIKE GUTTING OR SKINNING

Spoilage micro-organisms come mainly from the surface of the shark and their intestines. Experience has shown that a large part of the surface micro-organisms can be removed by proper washing.

During the dressing, eviscerating (gutting), or trimming operations, each shark should be washed by a flow or spray of potable water or clean sea water which is sufficient in quantity and pressure and is applied in such a manner as to clean the shark thoroughly. Water used for washing, rinsing or conveying, should be recirculated unless suitably treated to maintain a potable level of quality (SF 4.4.2.4/Mod).

5.4.3.2 THE SHARK SHOULD BE HEADED

For preparing the carcasses the head must be taken off, beginning from the pectoral fin, cutting away the branchial zone and breaking the bone.

5.4.3.3 UNGUTTED SHARKS SHOULD BE GUTTED WITH CARE AND ALL GUTTED SHARKS SHOULD BE THOROUGHLY WASHED

If not already done at sea, the shark is gutted and the liver removed and collected. In all cases, the belly cavity is carefully cleaned by means of water and a brush if required. All traces of blood and black parts must be removed.

5.4.3.4 THE LIVER AND FINS SHOULD BE REMOVED TO SEPARATE PROCESSING AREAS

If not already done at sea, the liver should be put into a separate contained and be chilled and/or frozen an processed as quickly as possible. The fins should be removed in the manner as described in processing at sea, collected in a container and cleaned and trimmed.

5.4.3.5 IN SOME PRESENTATIONS, THE TAIL SHOULD BE REMOVED

Whether after trimming the tail should be removed or left on depends on size of the sharks and the requirements of the trade. If the natural form of larger sharks is important after freezing, freezing in suspended form is required. The tail would then be removed after freezing. Accordingly, the way to bleed the sharks on board fishing vessels has to be coordinated, for example, cutting the tail veins instead of cutting the entire tail off.

5.4.3.6 IN SOME PRESENTATIONS, THE SHARK IS SKINNED

Normally the skin is left on in order to protect the meat and in particular to delay oxidation. Some small shark species, especially the spur dogfish (Squalus acanthias) can easily be skinned by pulling away the skin from the body and such species are mostly marketed without skin. Here the shark is not headed, and when gutted a cut is first made across the throat in front of the pectoral fin girdle. The shark is then cut open along the mid-ventral line to beyond the pelvic fins, otherwise the skin is difficult to pull off. After gutting and trimming the fins and tail, the head of the shark is firmly fixed on a "S" hook secured to the edge of the cutting board. Taking hold firmly of the belly flap and base of pectoral fins and pulling up an back towards the tail, the skin should be completely pulled off. After removing the hook the head is removed by a cut from the dorsal surface behind the gills. Pliers are used to remove the small piece of skin remaining. This procedure is, however, not possible with all small species.

5.4.3.7 LARGER SHARKS NEED TO BE TRIMMED

After gutting, washing and beheading, the shark may be transferred to a trimming table where the white meat is separated from trunk and skin and cut in longitudinal chunks, including the meat from the belly and chest area. The dark (red) meat is cut away and put into a container for waste.

Note: Sharks have in contrast to bony fish no rib cage. The muscles are attached directly to the skin. This and the robust fibrous structure of the skin make for hard work separating meat from skin. Furthermore, the scales of the sharks are small placoid plates, called dermal denticles. They make any knife blunt within a short time. These natural features cause delay in processing large sharks and these delays have to be taken into consideration when planning the utilization of the meat.

5.4.3.8 CHUNKS OF MEAT NEED BE CUT TO MARKET REQUIREMENTS

The chunks of white meat are normally put onto trays and carried to filleting tables where they are cut to market requirements.

5.4.3.9 AFTER PROCESSING, THE SHARK PRODUCT NEEDS BE WASHED IN BRINE OR SOAKED

In general, carcasses and fillets for freezing are thoroughly washed in a salt solution (500 g of salt to 10 l of potable water), then packed and frozen. Fresh meat for immediate consumption is briefly washed in a 5% salt solution and then closely packed in ice. Fillets from some shark species may need soaking in brine for a few hours up to 24 hours. Soaking can also be accomplished using a 1.5% solution of lactic acid. Citric acid can also be used for soaking. Very fresh shark meat can be soaked in water or put in ice for 24 hours, to lose the specific "shark" taste which results from the urea content. In general, the need for soaking and the length of the soaking time depend on the freshness of the meat and the kind of shark.

5.4.3.10 WHERE APPROPRIATE SHARK PRODUCTS SHOULD BE PACKED AS QUICKLY AS POSSIBLE

Unnecessary delays during packaging would allow products temperature to rise increasing the spoilage rate and damaging the quality of the final product.

5.4.4 Freezing and cold storage

5.4.4.1 DURING FREEZING, THE TEMPERATURE OF THE PRODUCT SHOULD BE LOWERED TO SUCH AN EXTENT THAT AFTER THERMAL EQUALIZATION THE TEMPERATURE OF THE PRODUCT IS THAT OF THE FREEZER STORE OR BELOW

Products should not be placed in frozen storage until their temperature has been brought down to that of the freezer store. The freezer store is designed to hold products at the proper frozen storage temperature and should not be used either for freezing shark or for reducing the temperature of a frozen product to the temperature level of the freezer store (MF 4.4.-7.6).

5.4.4.2 BLAST FREEZERS SHOULD BE OPERATED IN SUCH A WAY THAT THERE IS A SUFFICIENT FLOW OF COLD AIR AROUND THE PRODUCT

In this process, heat is transferred from the product to a cold air stream and carried to the cooling surfaces of the freezer. Adequate air circulation is essential and any obstruction to the flow of air around the product will result in poor freezing rates and variable product quality. If product units are placed too close together because of overloading the freezer, cold air circulation around the surfaces of individual units will be obstructed and freezing times may be greatly increased. Wrapping the product or placing it in cartons will also slow down the rate of freezing.

Larger carcasses may be suspended during freezing to maintain the natural shape (MF 4.4.7.3/Mod).

5.4.4.3 PRECISE FREEZING TIMES FOR SHARK AND SHARK PRODUCTS SHOULD BE CAREFULLY DETERMINED

The freezing time required for different products is influenced by many variables, such as product shape and size, composition, the area exposed to the refrigerated surface of the refrigerated medium, and the temperature of the refrigerant. Because of the varying size of sharks and their products, a guideline must be established as to how long each product or shark of a different size must be frozen (MF 4.4.7.2/Mod).

5.4.4.4 SHARK AND SHARK PRODUCTS SHOULD BE STORED AT TEMPERATURES APPROPRIATE FOR THEIR SPECIES, TYPE OF PRODUCT AND INTENDED TIME OF STORAGE

Cold storage temperature should be -25 deg. C (-13 deg. F) or lower. Fluctuations of more than 2 deg. C (4 deg. F) in the freezer store temperature should be avoided as fluctuations promote dehydration of the stored products. The air velocity in cold stores should be moderate and no higher than necessary to achieve sufficiently uniform temperature within the store.

5.4.4.5 THE PRODUCTS SHOULD BE STACKED IN THE FREEZER STORE SO THAT THERE IS ALWAYS SPACE FOR COLD AIR TO CIRCULATE ALONG THE WALLS AND THE FLOOR

Although distances of 5 - 10 cm (2 - 4 in) from walls and floors are sometimes regarded as adequate, occasionally large gaps may be required. Where possible, pallet storage should be practised, allowing air spaces below and around the outside of the stacked products. If this is done, then heat which might leak into the room will be absorbed by the circulating cool air instead of being absorbed by the products. This requirement does not apply in cases of jacketed freezer stores (MF 4.4.7.11).

5.4.4.6 ACCURATE RECORDS OF ALL FREEZING AND COLD STORAGE OPERATIONS SHOULD BE KEPT

An accurate record of all loading and unloading times of the freezer and amount and type of product will greatly assist in the efficient management and control of the operations.

Products held in frozen storage should be clearly identified and records should be kept to prevent older stocks from being allowed to deteriorate in quality through lengthy storage while newer stocks are being passed into distribution channels. A "first-in, first-out" principle should be followed (MG 4.4.7.5/ 4.4.7.12/Mod).

5.4.4.7 SHARK AND SHARK PRODUCTS THAT ARE NOT PACKAGED OR WRAPPED SHOULD BE GLAZED AS SOON AS THEY ARE REMOVED FROM THE FREEZER

Glazing will prevent dehydration and will also decrease rancidity. Glaze should be applied to frozen shark or shark products by brushing quickly or spraying with potable water or a solution containing an approved glaze additive or by immersing them therein. The temperature of glazing solutions should not be above 5 deg. C (41 deg. F) and the temperature rise to the shark should be kept to a minimum . The product may be dipped several times in succession to increase the thickness of the protective ice film. On prolonged storage, the glazed shark should be checked periodically for the deterioration of glaze.

5.4.5 Salting

5.4.5.1 SHARKS SHOULD BE SPLIT, FILLETED, PORTIONED OR SCARIFIED BEFORE SALTING TO ALLOW FOR MORE EFFECTIVE AND UNIFORM SALT PENETRATION

The number of micro-organisms responsible for the decomposition of fresh shark increases rapidly until the salt content of the flesh reaches a concentration of more than 3% . To ensure that the muscle during salting will attain this level in the shortest possible time, the shark must be so split or portioned or scarified so that the thickness of the flesh is not more than 4 cm. Furthermore, to reduce the microbial action as soon as possible, the flesh that has been split or portioned or scarified may also be rubbed with fine granulated salt (SA 5.4.3.7).

5.4.5.2 SKINNED CARCASSES REQUIRE SPECIAL TREATMENT

If the meat is deemed acceptable for processing, the white meat of the carcass can be used after all the dark (red) meat has been cut away and discarded. Chunks of white meat are cut into fillets which can be better treated and salted.

Most fillets need to be soaked for 2-6 hours in a 10% brine solution which should be cooled. This brine should be changed if necessary, but at least every day. In difficult cases, the fillets should be washed briefly in the brine and then kept in a new 10% brine for 24 hours in a chill room. Afterwards the fillets should be washed briefly in a new brine. Then they are ready for salting.

In general, the need for soaking and the length of the soaking time depend on the freshness of the meat and the kind of shark. Very fresh shark meat, especially of some species such as Squalus acanthias, does not need to be soaked. Hammerhead shark must be soaked thoroughly even if completely fresh. When processing different species of shark in one batch, the fillets

must be allowed to soak long enough for the "shark" smell and taste to be removed from all fillets. Soaking contributes also to achieving dried fillets of white colour.

5.4.5.3 SHARK SHOULD BE RUBBED WITH FINE GRANULATED SALT BEFORE CURING

After washing or soaking, split shark or fillets should drain for about ten minutes,then each shark or fillet be salted by rubbing fine grade salt (grains about 1 mm or less) well into the flesh. This will help reduce microbial action in the initial stages of the salting process.

5.4.5.5 SHARK INTENDED FOR PICKLING SHOULD BE CAREFULLY SALTED AND PROPERLY PACKED INTO THE CURING CONTAINER

A thin layer of salt should be spread evenly over the bottom of the curing tank or vat. Then a layer of shark, if unskinned with skin side down, is laid evenly over the layer of salt and more salt then is spread over the cut surfaces of the shark. Subsequent layers of shark should be placed at right angles to the layer beneath in such a way that no shark is overlapped without a proper layer of salt between. This will prevent the sharks from sticking together and becoming spotted and discoloured where they overlap.

More salt should be used on the sharks near the top than at the bottom. The top layer should be placed with the skin side up to prevent dust and other impurities from depositing on the cut surfaces of the shark. There must always be crystalline salt on the top layer of flesh since this prevents spoilage. The shark should be thoroughly mixed with the pickle during the curing and all shark should be well immersed in the resulting brine. If necessary, the sharks should be weighted down by a heavy lid and if there is not enough pickling juice formed to cover the shark, saturated brine should be added. Where possible, pickling should be done at a chill-room temperature (SA 5.4.4.4/SS Mod).

5.4.5.6 SHARK INTENDED FOR DRY-SALTING SHOULD BE PROPERLY ARRANGED TO ENSURE UNIFORM CONDITIONS AND PROPER DRAINAGE

In dry-salting (kench curing), two or three rows of sharks are placed down the centre of a drainage rack, which is covered with a layer of salt, and salt is sprinkled over each shark particularly on the thicker portions. A pile is formed gradually working out to the edges of the rack. At all times the sharks at the centre of the pile is kept 7 to 10 cm higher than the edges. For first salting, piles should not be higher than 1 m but in subsequent re-stacking, with the addition of fresh salt to ensure uniform curing conditions and pressing, piles of a greater depth are possible. Round piles are prepared by placing the tails of the shark towards an open centre.

There should be no pockets in the pile that will cause irregular drainage. If pockets are present, the shark around the area will become tainted and dark resulting in an inferior grade product. The edges of the pile should be checked frequently and

fine salt should be sprinkled over the napes of the shark which are affected by drainage from the pile. Piles should never be placed directly on the floor unless it has been specifically designed for the purpose.

The amount of salt, the time and temperature should be carefully controlled to attain the desired product. The amount of salt to shark may range from 1 unit of salt to 8 of shark by weight for light salting, to 1 unit of salt to 3 of split shark for heavy salting. Time in the cure may range from 2-3 days for light salted fillets, 6-8 days for split shark to 21-30 days for heavy salting. In view of the multiplicity of the factors involved, only through experience can the proper curing conditions be ascertained. Dry-salting of shark should be carried out in a cool room with a temperature below 10 deg. C (50 deg. F) for the control of special salt tolerant micro-organisms (SA 5.4.5.1/Mod).

5.4.6 Smoking of shark

5.4.6.1 BEFORE SMOKING, THE SALT CONTENT OF HEAVILY SALTED SHARK MUST BE REDUCED BY PROLONGED IMMERSION IN CLEAN WATER

Desalting in running water, although preferable, is not practical or economical because of the large quantities of water involved. Salted fish is usually immersed in tanks with an equal amount of water. The process should be carried out at temperatures not higher than 10 deg. C (50 deg. F).

To secure uniform results, the sharks should be regularly stirred. The salty water, being heavier than the fresh water, will sink to the bottom of the tank resulting in an uneven distribution of salt content in the final product (SM 4.4.3.8).

5.4.6.2 IMMEDIATELY AFTER SALTING OR DESALTING, SHARK SHOULD BE SUSPENDED ON RODS (TENTERS) OR HOOKS, OR LAID OUT ON TRAYS FOR DRYING AND SMOKING

After salting or desalting, sharks should be subjected to drying which could be carried out in an open area or in a mechanical dryer under controlled conditions. For this reason and for the purpose of subsequent smoking, shark should be suspended on rods, hooks or laid out on trays. Care should be taken to ensure that the suspended sharks do not touch each other otherwise they will be unevenly smoked and damaged physically during the separation (SM 4.4.3.9/Mod).

5.4.6.3 "DRIPPING" AND DRYING OF SHARK PRIOR TO SMOKING SHOULD BE CARRIED OUT UNDER CONTROLLED CONDITIONS AND IN AN HYGIENIC MANNER

Dripping or drip-drying and drying of shark after salting or desalting, refer to the removal of the adhering surface water and evaporation of the surface moisture. If it is done properly, the formation of a glossy pellicle will result. The pellicle is important because it helps to seal the natural juices and flavours of the shark flesh and forms a smooth and attractive surface upon which the smoke can evenly be deposited.

The flesh of shark, if smoked before a pellicle is formed, will exude juice which will coagulate into a white curd when exposed to higher temperature or in case of cold smoking will support the growth of micro-organisms resulting in off-odours, sour taste and mushy texture.

Drying of shark may be done outdoors providing there is no chance for contamination by insects, birds and dust or in the smokehouse. An ideal system is in the chill-rom with the aid of a blower where a steady current of cool, clean air should be provided (SF 4.4.3.10).

5.4.6.4 FOR SMOKE PRODUCTION, THE WOOD, WOOD SHAVING OR SAWDUST SHOULD BE DRY AND FREE FROM SOIL, DUST AND HARMFUL SUBSTANCES SUCH AS WOOD PRESERVATIVES AND PAINT

Soft resinous woods give the product an acrid unpleasant taste. The best combustion temperatures for the wood are in the range of 250-350 deg. C (482-662 deg. F). Temperatures of more than 400 deg. C (752 deg. F) are to be avoided because of the development of undesirable components in the smoke.

Wet or mouldy sawdust should not be used; however, depending on the type of wood an the nature of the operation, it may be desirable to use damp sawdust. It is bad practice to use water during the smoking operation for damping the fire in an attempt to regulate the rate of sawdust burning (SM 4.4.4.1).

5.4.6.5 ASH DERIVED FROM BURNING WOOD OR SAWDUST SHOULD BE PREVENTED FROM BEING DEPOSITED ON THE PRODUCT

It is important, therefore, that the current of air passing the burning wood or sawdust is not so fast that it carries burned particles (ash) into the kiln. Ash should not be allowed to accumulate in large amounts in the boxes where smoke is generated.

The use of smoke scrubbers for the removal of fly-ash, soot and tars is recommended. It may be necessary to recirculate the scrubbing water which rapidly becomes saturated with the lighter fractions which impart the desired smoke flavour. Colour development of the product might be affected (SM 4.4.4.2).

5.4.6.6 SHARKS SHOULD BE SMOKED WITH CARE AND IN SUCH A MANNER AS TO PROVIDE FOR UNIFORM SMOKE ABSORBTION, TEMPERATURE EXPOSURE AND DEHYDRATION

As mentioned earlier, shark should be hung or laid out on trays without overcrowding and touching each other. In traditional kilns, the position of the shark in relation to the fire should be changed frequently. The same requirement will also apply to mechanized kilns where electric fans are used and where the sharks are located directly in front of the air/smoke inlet. If no remedial action is taken a distinctly darker colour, a bitter tarry taste and a tougher texture will result.

To obtain even smoking and dehydration of the shark in the same batch, the shark portions should be of reasonably uniform size and weight.

Many different products can be made from smoked shark, from hot smoked belly flaps of the spiny dogfish (Squalus acanthias) called "Schillerlocken" or the body of the same species sold under the name "Seeaal", to a smoked salmon substitute (SM 4.4.4.4/Mod).

5.4.6.7 DURING COLD SMOKING THE TEMPERATURE OF THE SHARK SHOULD NOT EXCEED A LEVEL AT WHICH HEAT COAGULATION OF PROTEIN TAKES PLACE

Cold smoking, by definition, means smoking of sharks at temperatures where the product does not show any signs of heat coagulation of the protein. There is a possibility that if during cold smoking the temperature of the flesh is allowed to rise that protein will be coagulated and parts of the shark will be cooked. Such products will not have the elasticity and flexibility of the properly cold smoked product.

During cold smoking, the relative humidity should at first be maintained at about 90% to facilitate smoke absorbtion but subsequently dropped to about 70% to achieve the required amount of drying. If it is much higher than 70% during the drying period the drying will be too slow; if considerably lower, the fish will dry too quickly, resulting in case hardening and poor smoke absorption.

If an extended shelf like is desired, there should be a minimum salt concentration of 8% of the water phase of the muscle before cold smoking (SM 4.4.4.6).

5.4.6.8 DURING HOT SMOKING THE TIME TEMPERATURE COMBINATION SHOULD BE SUFFICIENT TO OBTAIN A COMPLETE COAGULATION OF THE PROTEIN

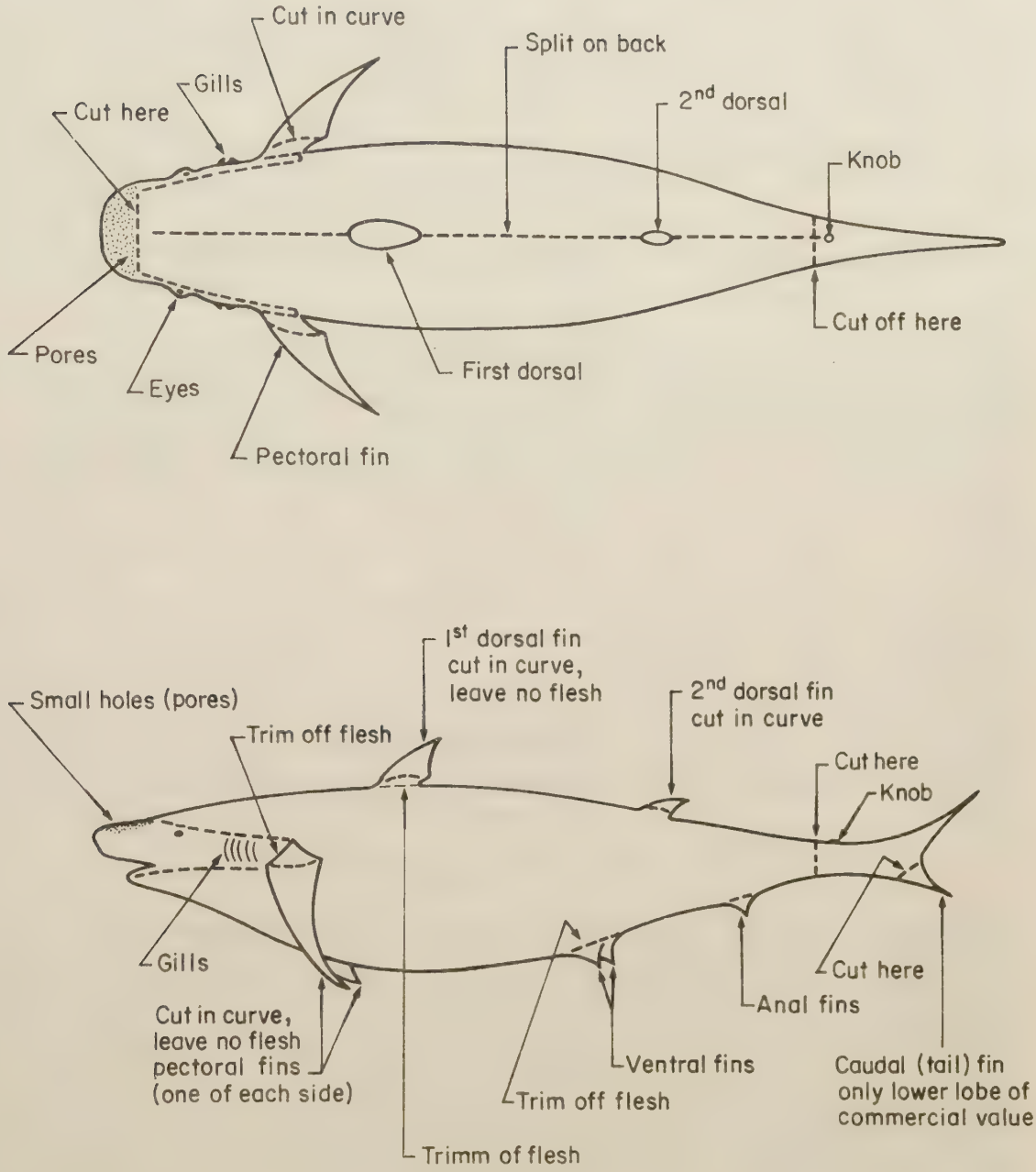
It should be stressed that hot smoking does not necessarily suppress the outgrowth of Clostridium botulinum time E and toxin production. Lightly salted products with a higher water content processed by the hot smoking method are highly perishable. If not consumed immediately, the product should be chilled as soon as possible (SM 4.4.4.7).

5.4.6.9 AFTER COMPLETION OF SMOKING AND BEFORE PACKAGING THE WARM PRODUCTS SHOULD BE IMMEDIATELY COOLED TO THE AMBIENT TEMPERATURE OR LOWER. AFTER PACKAGING THE PRODUCT SHOULD BE COOLED FURTHER WITHOUT DELAY

When smoking is finished, the product should be cooled rapidly and thoroughly before it is packaged; otherwise it will turn flabby, moist and sour or mouldy. Cooling too slowly may promote the growth of micro-organisms harmful to humans.

Cooling can be conducted in an ambient temperature or in a chill-room provided the humidity is not too high and there is a continual movement of clean, cool air or the kiln itself can be used for cooling at the end of the working day if it is equipped with cooling coils (SM 4.4.4.8/Mod).

5.4.7 Skinning and curing hides (Fig. 1 and 2)



-------- *Cutting lines*

Figure 1 Pattern for skinning sharks

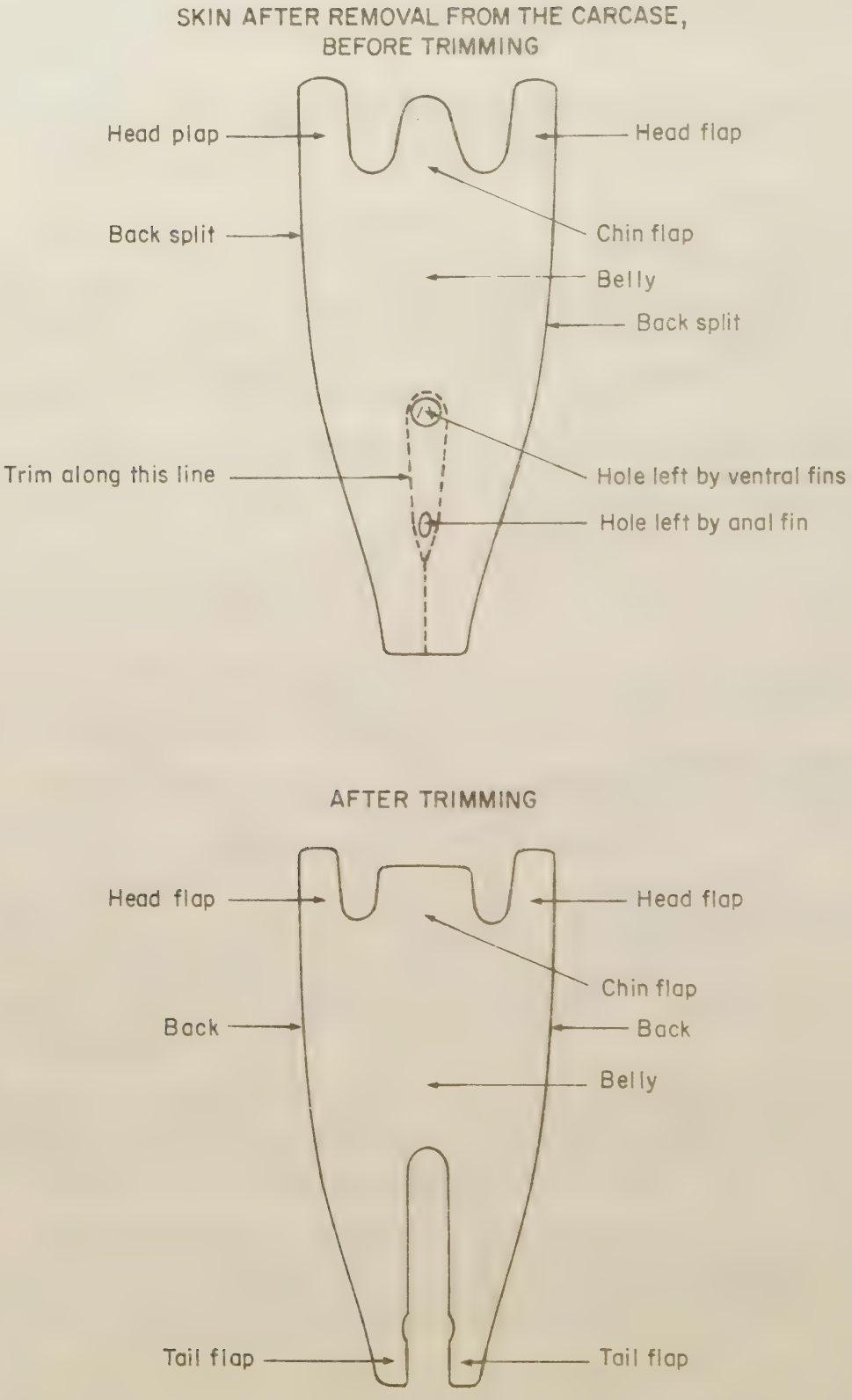


Figure 2 Skinning of shark

5.4.7.1 ONLY GOOD QUALITY SKINS SHOULD BE RECOVERED

Large sharks to be skinned or fletched are not gutted at sea and not iced, as fresh water would spoil the skin. Any washing of the shark both at sea and on land, therefore, has to be done with seawater. In order to obtain good quality leather the shark needs to be skinned as soon as possible after it is landed, and the skin thoroughly cleaned of flesh. The production of good quality hide is almost entirely dependent on immediate skinning and salting before decomposition can begin. As sharks spoil more rapidly than other fishes, the maximum skinning and salting time limit cannot exceed 24 hours. Warm and humid climates reduce this period to a few hours.

5.4.7.2 THE SHARK SHOULD BE ADEQUATELY SUPPORTED DURING FLETCHING

Shark is generally skinned on a platform over the water such as a dock or the deck of a boat, but this depends on local conditions. The shark is suspended from a substantial hook passed through the upper jaw. The hook, in turn is attached to a heavy gauge steel or wooden supporting structure of the rigging of a boat. The supporting structure can be in the form of a tripod or as a wall projection. Alternatively, the shark can be flayed on a "stretcher" comprised of two stout poles some 3.4 m long connected by ropes of 0.5 m length which is used to transport the dead shark to avoid damage to the skin when dragged over the ground. While resting on 1 m supports, the shark can be handled one side at a time while lying on its belly on the stretcher. If neither a raised slung position nor suspension can be achieved, the flaying can be carried out rather less conveniently, in some respects, with the carcass laying belly down on the ground, provided that some simple means can be adopted to prevent it from rolling over to one side.

5.4.7.3 SHARKS SHOULD BE FLAYED WITH CARE

The minimum time required for the skinning of one average shark may range from 15 to 30 minutes depending on the skill of the operator. As mentioned before, sharks have in contrast to bony fish no rib case, the muscles are attached directly to the skin. This and the robust fibrous structure of the skin are the cause for the hard work involved in skinning big sharks. Furthermore, the scales of the sharks are small placoid plates, called dermal denticles, they make any knife blunt within a short time. These natural features cause delay in processing large sharks. It must be emphasized that skinning of shark is hard manual work.

The first step in flaying is to remove all fins. The first main cut is made down the midline of the back. A very sharp knife should be used throughout the operation. The knife is first inserted in the holes already made by removal of the dorsal (mid-back) fins and a cut made forward to the upper front of the head and back to the knob near the tail. The next step is to cut off the tail just in front of the knob. Cuts are now made around the head, behind the gills and pectoral fins, then

ventrally and forward round the edge of the lower jaw. The skin is "peeled off" by freeing it from the carcass with the knife, the blade being kept flat against the skin to avoid flay cuts which would lower its value. During the removal of the skin, it is important not to pull on it too hard as this would produce a "thin" belly area and will thus reduce the sales value. Delay in skinning may give rise to "sour spots", i.e. areas of tissue breakdown. Pneumatic deskinning tools used for skinning livestock have been successfully used for shark.

5.4.7.4 IN ORDER TO FACILITATE FLESHING, THE HIDES SHOULD BE SOAKED IN A SIX PERCENT BRINE SOLUTION

Immediately after flaying, the skins are washed well or hosed with sea water (if flayed aboard the fishing vessel) to remove blood and slime, then the hides are immersed for a minimum of 3 to 4 hours in a 6% brine solution (6 kg common salt plus 96 l of freshwater) containing a disinfectant such as sodium hypochlorite to avoid the development of red halophilic microorganism before fleshing, which is facilitated by this brine soak. One hundred litres in a 200 l barrel will hold 15 to 20 shark skins. Depending on conditions, the soaking could be carried out overnight if stored in a cool place.

5.4.7.5 SHARK HIDES SHOULD BE FLESHED WITH CARE

Fleshing is the removal of the residual connective and adipose tissue from the flesh side of a hide or skin after flaying. Fleshing is carried out with a "beaming knife" (a 40 cm long, dull, curved steel blade having a single edge and a handle at each end) and a stout "beaming board" (a board about 1 m wide and 1.5 m long with a curvature across the width, its shape matching that of the beaming knife). The surface of the board must be kept clean and smooth, a hard rubber sheet placed on top of the beaming board would further facilitate fleshing.

The board is rested on the floor, the upper end supported at an angle so that it is about the level of a man's waist. The flesher leans against the board and removes the surplus flesh by pushing the knife downward and away from him keeping it pressed against the flesh side of the skin on the board with the single blade edge up. Any remaining flesh tissue at the edges is neatly trimmed away, then the tail end of the skin is split by cutting around the ventral fin rudiments and vent, through the hole left by the anal fin and then in a straight line to the end of the skin.

Note: The fleshing knife or "beaming knife" may have one quarter of the knife having a sharp edge for removing cartilage and hard parts of the meat, and three quarters having a dull edge for removing meat parts. Where this is the case, the diameter of the "beaming board" should be smaller than the diameter of the beaming knife.

5.4.7.6 SHARK HIDES SHOULD BE CURED WITH CARE

Immediately after fleshing, the skin is given another wash in seawater and drained for ten minutes. A generous amount of salt is then applied on the flesh side of each skin, extra salt being rubbed along the cut edges. An approximate note must be made of the weight of the skin (green skin) before application of salt because the amount of salt added should be about one third of the green weight. Mineral salt is best having a crystal size of 2-3 m.

The skins should be stacked one on top of the other with ample salt between each, flesh side up, in piles up to 1.5 m high. The piling should be carried out on a platform with a 1 in 10 slope, or on a hessian covered pallet similarly sloped to assist the brine in draining away. A generous layer of salt (up to 2-3 cm thick) should be put on the platform or slope used for the pile before the first skin is put down. The pile can be remade after the first day by simply reversing the order of the first pile as the skins are repiled on a second platform in the same manner as before, adding more salt between the skins if thought desirable. In either case, the time in pile should not exceed five days, and at no time should the curing skins be exposed to rain or direct sun. A defect "burnt skin" can result if the skin is exposed to direct sun.

5.4.7.7 CURED HIDES SHOULD BE PROPERLY FOLDED AND STORED

At the end of the curing period, the pile is taken down, residual salt shaken off the skins, a fresh application of salt made on the flesh side, and the skins then successively folded (flesh side inwards) to prevent salt being lost. The folded skins may be rolled into round bundles and tied carefully with twine ready for packing for transport in containers which permit air circulation, e.g. burlap or sisal bags, hessian or braided matting. Care should be taken to ensure that the skins are protected against rain or any other physical damage which could occur during transport. Packing should be secure, and the product should be kept cool to avoid heat damage.

5.4.7.8 DEPENDING ON MARKET REQUIREMENTS, FROZEN UNCURED HIDES MAY BE PREPARED

Some tanners may wish to do their own curing, and if cold storage facilities are present and it is economic to do so, this may also be considered. After fleshing, a generous amount of salt is sprinkled on both sides of the skin. Ten to fifteen skins can then be rolled on folded and packed in a polyethylene bag and kept in a cold store until shipment.

5.4.7.8 DEPENDING ON MARKET REQUIREMENTS, A PRE-TANNED HIDE MAY BE PREPARED

Some tanners may wish the hide to be pre-tanned after fleshing. One such method is to place each skin in a solution of K-Alum ($KAl(SO_4)_2$-$12H_20$) 1.5 kg, salt 3 kg, and water 50 l for a period of 5 to 7 days. This solution can treat more than one

skin but the salts need to be augmented to compensate for absorption. The solution should be disposed of if it smells bad. After cleaning these skins may also be dried.

5.4.8 Processing of shark fins (Figs. 3 and 4)

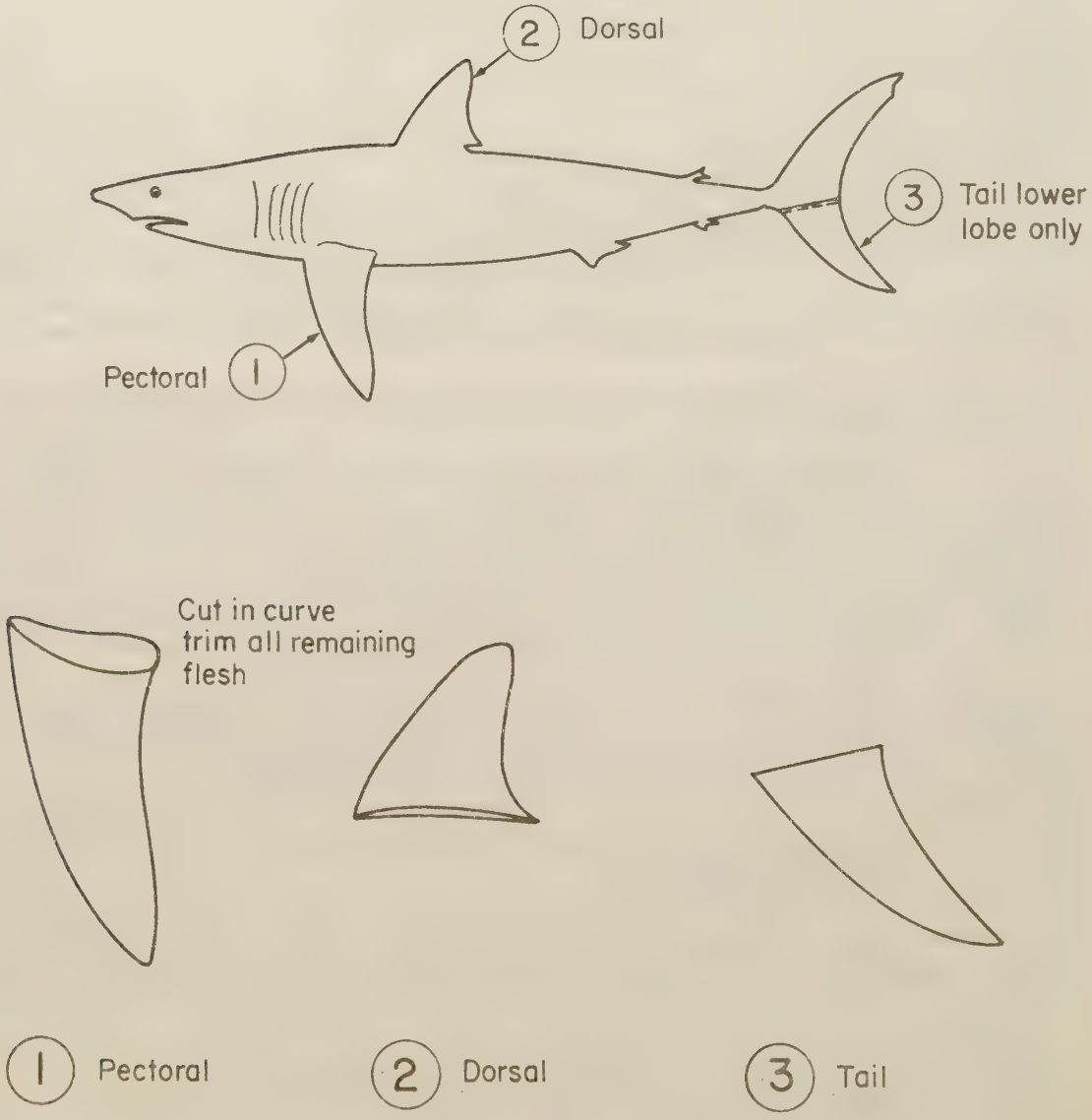


Figure 3 Commercially valuable fins

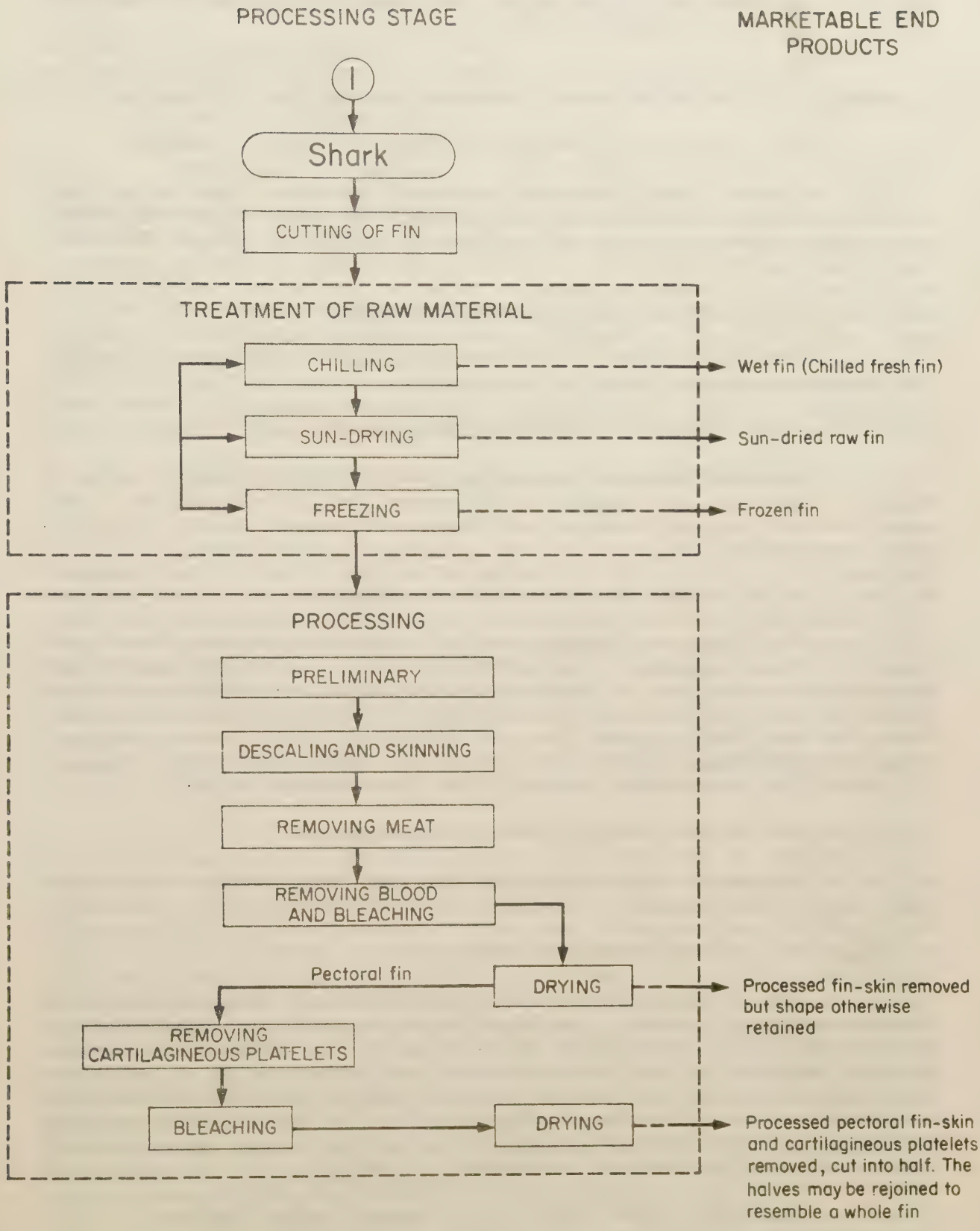


Figure 4 Shark fins processing stages and the related end products

5.4.8.1 IF NOT CUT AT SEA, THE FINS SHOULD BE REMOVED FROM THE SHARK AS SOON AS POSSIBLE

Fins should be cut, trimmed and sorted as described in section 4.6.3 of this code, processing the fins on board.

5.4.8.2 CUT FINS MAY BE MARKETED FRESH, DRIED OR FROZEN

If newly cut fins are to be sold within a few days, they can be washed with seawater and stowed in ice. Alternatively, they may be cleaned with a 3% brine solution or clean seawater and dried or frozen.

5.4.8.2 CUT FINS MAY BE FURTHER PROCESSED

The final product, processed fin, is fin with skin off but otherwise retaining its shape.

5.4.8.3 FINS ARE GIVEN PRELIMINARY SOAKING

Frozen fins are thawed in water and soaked for 8 to 9 hours. Wet fins are washed and soaked for 8 to 9 hours. Dry raw fins are put into water and soaked for about 16-20 hours to make them soft.

5.4.8.4 FINS SHOULD BE DESCALED AND SKINNED

The fins are further soaked in water pre-heated to 80-90 deg. C. This warming loosens the scales and skin but has to be carefully controlled to avoid spoiling the fin needles. A wire brush is used to test that the scales are sufficiently loosened. The fins are then dipped into chilled water and a metal scraper used to completely remove the scales and underlying skin. Finally, the fins are washed again with fresh water.

5.4.8.5 ANY ADHERING MEAT SHOULD BE REMOVED

Any meat attached to the fin and base of the cartilaginous platelets should be cut away.

5.4.8.6 ALL BLOOD SHOULD BE REMOVED

The fins are put into running water, soaked and hand washed several times. The blood in the cartilaginous base of the shark fin is difficult to wash away, so bleaching is generally necessary. One bleaching method is to use a 3% hydrogen peroxide solution for 30-40 minutes, after which the fins are thoroughly washed in fresh water. Half a litre of concentrated hydrogen peroxide solution is sufficient to treat about 8-9 kg of fins. The product is now ready to be dried.

5.4.8.7 PREPARED FINS SHOULD MEET MARKET REQUIREMENTS

The final product is fin with skin off but otherwise retaining its shape. Other processes call for removal of the very hard and non-edible cartilage of the dorsal fins before drying,

and others, the removal of the cartilaginous platelets between the two layers of fin needles in the pectoral and dorsal fins.

5.4.9 Drying of shark

5.4.9.1 SHARK AND SHARK PRODUCTS SHOULD BE DRIED TO A LEVEL OF PRODUCT STABILITY

Water is essential for life and bacteria and enzymes in shark flesh require plenty of water to function effectively. The removal of moisture can slow down or even stop completely the action of spoilage bacteria and enzymes. When the water content of shark falls below 25% of the wet weight, bacterial action stops, and when the water content is further reduced below 15%, moulds cease to grow. When salt is added to the fish before drying, less water needs to be removed to achieve the same effect, and a product with a water content of 35-45% depending on the amount of salt present, is often dry enough to inhibit the growth of moulds and bacteria under most climatic conditions. Salted shark should be dried to a water content of about 35%.

5.4.9.2 PRODUCTS SHOULD BE DRIED UNDER APPROPRIATE AIR CONDITIONS

There comes a point, in any fish drying where it is impossible to remove any more water and this point is dependent on the relative humidity of the air. The addition of salt to the product before drying changes the physics of evaporation from the surface of the product. This means in practice that most salted shark will not dry readily in air whose relative humidity is higher than 75% because the salt will absorb water vapour from the surrounding air.

5.4.9.3 PRODUCTS SHOULD BE DRIED IN A MANNER THAT PREVENTS CASE HARDENING

In the first stage of drying, water on or close to the surface evaporates, and the drying rate depends on temperature, the speed of movement of air, and dryness of the air (relative humidity). Once the surface water has evaporated, water can then evaporate only as fast as it can reach the surface of the fish from within, and the rate of diffusion from the deep lying parts of the flesh become progressively slower as drying proceeds. If drying during the initial period has been very rapid, a condition known as "case hardening" occurs. The surface layers dry quickly producing a hard layer which is impervious to the passage of water. This layer then prevents migration of water during the water migration period and the centre of the fish can become spoiled although to all intents and purposes it looks well dried. Thus, it may be necessary to dry some products in the shade and slow the drying. Further, a greater proportion of the weight can be evaporated during the initial stage if drying is slow.

5.4.9.4 SMALL PORTIONS OF SHARK AND FINS SHOULD BE CAREFULLY SUN-DRIED

Small portions are placed in a single layer on a wire screen, or some other rack to dry. If the portions are salted heavily enough to keep them from spoiling, drying in the shade makes a better product as there is apt to be some case-hardening from very rapid drying in the sun. It is good policy to leave the drying portions exposed to the sun for the first three to four hours in the morning then place them in the shade where a good breeze can blow across them. The portions should be turned over every hour or two to promote even drying.

5.4.9.5 SPLIT SHARK AND LARGER PORTIONS OF SHARK AND LARGER FINS SHOULD BE CAREFULLY SUN-DRIED

Larger portions may be strung out on hooks suspended from poles or laid out on trays or racks. For the first day or so they should not be exposed to the bright sun at all, but after that they may be put out for three to six hours each morning and toward the end of the drying period left out all day. If the portions are laid out on trays they should be turned over four or five times a day to promote even drying. The split shark or portions should be roughly sorted by size before drying and if hung, they should not be hung so closely together that drying is impeded and they must not touch each other.

Shark needs to be of a size that can be dried properly, generally this has been done during the salting process since the same provisions apply for salting.

5.4.9.6 SUN-DRIED SHARK SHOULD BE PROTECTED AT NIGHT

At night the shark needs protection against the dew and as the relative humidity may rise above 75% at night, particularly in tropical climates, it is recommended the product be taken indoors at night or placed in a covered area in the drying yard. This will not only prevent the product from being dampened at high humidity but will also protect them from rain, theft and predators.

Individual sharks or racks should be stacked under cover where air can circulate, thus preventing heating, but moisture cannot reach them.

5.4.9.7 SUN-DRIED SHARK SHOULD BE PROTECTED FROM RAIN

Depending on local climatic conditions, the product need be either simply covered on the racks or taken indoors.

5.4.9.8 TO HASTEN DRYING, SHARK MAY BE "PRESS PILED"

Sharks should be stacked in piles about .75-1 m high and a gradually heavier weight is applied on top of each pile, starting with a weight about two-thirds the weight of the pile the first night and ending with a weight about three times that of the pile the last night. This procedure termed "press piling" will press the inside water to the surface, thus facilitate drying and flatten the portions saving space when sorting them

overnight. Further, press piling can be carried out during the night when the shark has to be protected against the dew.

5.4.9.9 DRYING SHOULD BE COMPLETE

It is difficult to say how long it will take the shark to dry. One kg portions may dry in about 3 days; split shark and strips may take a week to 10 days or even more. Fins may take from 2-5 days and a fillet 2 cm thick will take 2-4 days, but the actual drying time depends on the local climatic conditions, thus the fillets for example may need 6-7 days.

5.4.9.10 MECHANICAL DRYING MAY BE USED INSTEAD OF SUN-DRYING

Mechanical drying is of course much more expensive than sun-drying, however during rainy seasons, open air drying is impossible as drying can take place in day time only as long as the relative humidity in the air is lower than 75%. As shark fins are such a valuable commodity, they are often dried in an electric oven. A hot air kiln may also be used for fins or for meat as required, taking into account the above requirements for drying.

5.4.9.11 SHARK HIDES SHOULD BE DRIED WITH CARE

In some cases it may be necessary to dry the skin, however it must be done in a manner that does not damage the fibres. Usually rehydration does not constitute a problem unless the drying has been done in the open, fully exposed to the direct sun. The skins must always be dried in the shade in a well aired space, i.e. on suitable frames or lines under an open sided cover. Where it is done under cover, it is essential that the cover be raised high enough above the product to avoid trapping water vapour that would prolong the period required for drying and introduce the risk of putrefaction. It is best to stretch-dry the skins under tension in frames and in this case care must be taken in making the securing "lacing" holes. They should not be more than 1-2 cm from the edge of the skin and only large enough to take the tying material, otherwise there might be tearing or a reduction in skin value. If the hides are not laid flat when dried, heavy irreversible wrinkling results lowering the quality of the hide.

5.4.10 Salt and ingredient requirements

5.4.10.1 SALT USED IN THE SALTING OF SHARK SHOULD POSSESS AN APPROPRIATE COMPOSITION FOR THE PRODUCT

The composition of salt differs according to the origin. Mine salt is usually almost pure sodium chloride but solar salt of marine origin contains several other salts like calcium sulphate, magnesium sulphate and chloride as the main impurities, but limited amounts of iron and copper salts do occur. The presence of excessive amounts of calcium and magnesium salts in common salt used for pickling or dry salting may impart a bitter flavour and unattractive chalky appearance to the shark. When only impure salt is available, most of the calcium and magnesium

impurities can be washed away by using rainwater or potable water and draining off the wash water. This practice will remove those calcium and magnesium salts which are more soluble than sodium chloride.

5.4.10.2 SIZE OF SALT CRYSTALS SHOULD BE CONSIDERED IN SALTING SHARK

When producing a brine, it is useful to have a fine-grain so it dissolves quickly and easily. In dry-salting, small crystals tend to "burn" the flesh and result in discolouration in the final product and, therefore, large crystals are preferable. In some processes a mixture of salt crystal sizes are used i.e.: 1/3 salt mixture 1 mm or under grains, 2/3 salt mixture 3-5 mm grains. In salting hides, the salt should not be too fine, not much less than 2-3 mm crystal size, as it tends to cake into a solid block or, at least, become lumpy during storage making it less easy to apply evenly on the raw skins. Too-coarse salt presents other difficulties; it dissolves less readily so that it takes longer for the required salt concentration to be built up within the raw hides and it can cause permanent indentation defects in the grain, particularly under the pressure exerted when salted stock is piled.

5.4.10.3 SALT SHOULD BE FREE FROM MICRO-ORGANISMS WHICH ADVERSELY AFFECT THE QUALITY OF THE FINAL PRODUCT

Two particular conditions that can adversely affect the quality of dry salted shark are the occurrence of "pink" - a discoloration caused by red halophilic bacteria - and moulds. Both defects can be combatted by maintenance of a temperature lower than 10 deg. C (50 deg F).

Salt produced from marine sources may contain halophilic bacteria which continue to live in the salt and on dry salted fish. The bacteria multiply rapidly if the shark are stored at a temperature of 10 deg. C or higher and there is also sufficient moist air present in the storage area. The result will be the appearance of a "pink" or "red" colour, sometimes combined with cheesy "off odours". The surface of the shark can be reconditioned by thorough washing and subsequent re-drying but the discoloration will reappear if storage conditions remain unsuitable.

The presence of mould generally indicates poor storage, that is, the product has been allowed to become too damp and held at too high a temperature. Dried products should be washed and redried at the first sign of mould.

In order to minimize infections of salted shark, the re-use of salt should be avoided.

5.4.10.4 SALT INTENDED FOR HIDES CAN BE TREATED TO PREVENT "PINK"

The problem of halophilic bacteria is particularly acute with shark hides. Mineral salt is best and solar salt should

only be used if mineral salt is not available. One method to reduce "pink", is to treat the salt before curing the hides using 1% boric acid and 0.5% naphthalene. As the mixing needs to be thorough, a rotating (tannery) drum is necessary. In order to make 200 kg of salt, additions of the following nature are necessary:

(1) 1 kg naphthalene and 1 kg boric acid, (2) 1 kg boric acid, (3) 3 kg salt, (4) 6 kg salt, (5) 12 kg salt, --- (8) 96 Kg salt, (9) 11 kg salt. Drummed for 15 minutes between additions and finally for one hour after addition (9). It is strongly recommended to re-mix a batch of pre-treated salt after storing for one week to ensure reasonable homogeneity.

If during or after curing the skins show a tendency to become pink, or if after curing they develop damp "weeping" spots, the trouble is probably due to the salt used and the salt from a different source should be tried. Once this pink colour has appeared, everything, including the fleshing board and curing platform, should be thoroughly disinfected. When untreated solar salt is to be used, only matured, well-dried salt with no sign of pink colour should be used.

It has been the practice in some countries to recover and re-use salt swept from hides or skins before these are shipped or sold, sometimes after mixing with fresh salt. While it might be possible to adopt this practice with satisfactory results (the place where the salt is recovered must be particularly clean), it must be recognized that the risk of contamination of sound, fresh raw hides in this way, is very great. Consequently, in the light of the strong possibility of introducing contamination which would defeat the whole object of skin preservation, it can only be recommended not to re-use salt.

5.4.10.5 IF FOOD ADDITIVES ARE TO BE USED, THE ADVICE OF A FOOD TECHNOLOGIST SHOULD BE SOUGHT AND THE APPROVAL OF THE OFFICIAL AGENCY HAVING JURISDICTION SHOULD BE OBTAINED

Food additives cannot be used indiscriminately. Some are effective only with certain types of food, and in all cases the concentration and the time of contact of the additive must be rigidly controlled in accordance with specialist advice and the official agency having jurisdiction. Food laws differ from one country to another and it is essential to seek specialist advice before using a particular additive, whether the product is for domestic use or for export (MF 4.4.5.4).

5.4.11 Packaging, storage and distribution

5.4.11.1 PACKAGING MATERIALS SHOULD BE APPROPRIATE FOR THE PURPOSE AND SUFFICIENTLY STRONG AND DURABLE TO WITHSTAND STRESSES DURING PROCESSING, HANDLING, STORAGE AND DISTRIBUTION AND WHERE NECESSARY THEY SHOULD HAVE WATER VAPOUR AND GAS BARRIER PROPERTIES TO MEET THE REQUIREMENTS FOR THE PARTICULAR PRODUCT AND SHOULD BE OF THE PROPER SIZE AND SHAPE

If frozen, the packaging materials should not unduly increase the time required for freezing.

5.4.11.2 PACKAGING MATERIALS SHOULD BE OF A TYPE APPROVED BY THE OFFICIAL AGENCY HAVING JURISDICTION AND BE CLEAN AND STORED IN A HYGIENIC MANNER. PACKAGING SHOULD BE CARRIED OUT UNDER CONDITIONS THAT PREVENT CONTAMINATION OF THE PRODUCT

All packaging materials should be stored in a clean and hygienic manner. The materials should be appropriate for the product to be packed and for the expected conditions of storage and should not transmit to the product objectionable substances beyond the limits acceptable to the official agency having jurisdiction. The packaging materials should be sound and should provide appropriate protection from contamination. (SM 4.4.5.1).

5.4.11.3 CARTON WRAPPINGS AND OTHER PACKAGING MATERIALS SHOULD NOT BE STORED IN THE PROCESSING AREA

Delivery wrappings of packaging materials should be removed outside the processing area and only those packages required for immediate use at any given time should be introduced to the area. (SM 4.4.5.6).

5.4.11.4 LIGHTLY SALTED AND/OR SMOKED PRODUCTS SHOULD NOT BE KEPT IN CHILLED STORAGE LONGER THAN FOR A FEW DAYS

Such products spoil extremely fast and, if not distributed immediately, should be frozen. Only products with high salt content and low moisture can be kept longer without freezing provided the conditions are dry, well aerated and the temperature is relatively low. (SM 4.4.5.2/Mod).

5.4.11.5 VACUUM OR GAS PACKED SMOKED PRODUCTS SHOULD BE STORED AT AN APPROPRIATE SAFE TEMPERATURE.

If storage temperatures are above 3 deg. C (37 deg. F) there is a risk that Clostridium botulinum may grow in some types of smoked shark products and may produce toxins. Therefore, the use of such packaging should be restricted to frozen products. Frozen products should be kept frozen until required for consumption. When the frozen product is thawed, the package should be opened. Appropriate date marking and corresponding instructions on storage conditions should appear on the label. (SM 4.4.5.3/-Mod).

5.4.11.6 SMOKED AND SIMILAR PRODUCTS WHICH ARE NOT FROZEN SHOULD BE PACKED FOR TRANSPORT SO THAT THERE IS NO DIRECT CONTACT WITH ICE OR MELT WATER.

Intimate contact with ice or melt water will result in the leaching away of flavour and colour, softening of the texture and general deterioration of the product. (SM 4.4.5.4/Mod).

5.4.11.7 ONLY NEW DRY PACKAGING MATERIAL SHOULD BE USED FOR PACKAGING SALTED OR DRIED PRODUCTS

Salted or dried products should not be packed in wet or damp containers. The containers should be clean and free from any foreign matter. Containers that have previously been used for any purpose may have odours associated with them that could permeate the product to be packed therein. (SA 5.4.6.2/Mod).

5.4.11.8 SALTED AND/OR DRIED PACKAGED PRODUCT SHOULD BE STORED IN A DRY AREA THAT IS PROTECTED FROM CONTAMINATION AND IS ALSO WELL VENTILATED

Packaged product should be held in a dry area where it is protected from dust, rodents and contaminants. In addition, the area should be well ventilated and cool to protect the quality of the product if the product is to be stored prior to shipment. Circulation of air between the walls of the storage area and the containers of product will minimize deterioration as well as allow easier access to ensure that no harmful action is taking place to the containers themselves. (SA 5.4.6.4/Mod).

5.5 Hygiene Control Programme

5.5.1 IT IS DESIRABLE THAT EACH SHARK PROCESSING PLANT IN ITS OWN INTEREST DESIGNATES A SINGLE INDIVIDUAL WHOSE DUTIES ARE PREFERABLY DIVORCED FROM PRODUCTION, TO BE HELD RESPONSIBLE FOR THE CLEANLINESS OF THE ESTABLISHMENT

Such a person or his staff should be a permanent part of the organization, or employed by the organization, and should be well trained in the use of special cleaning tools, methods of dismantling equipment for cleaning and in the significance of contamination and the hazards involved. A permanent cleaning an disinfection schedule should be drawn up to ensure that all parts of the establishment are cleaned appropriated and that critical areas, equipment and material are designated for cleaning and/or disinfection daily or more frequently if required. (MF 4.5.1).

5.6 Laboratory Control

5.6.1 IN ADDITION TO ANY CONTROL BY THE OFFICIAL AGENCY HAVING JURISDICTION, IT IS DESIRABLE THAT EACH SHARK PROCESSING PLANT IN ITS OWN INTEREST SHOULD HAVE ACCESS TO LABORATORY CONTROL TO ESTABLISH HYGIENE AND QUALITY OF THE PRODUCTS PROCESSED AND TO MONITOR THE HYGIENE OF PROCESSING

The extent and type of such control will vary with the food product as well as the needs of management. Such control would reject all foods that are unfit for human consumption.

Analytical procedures used should follow recognized standard methods in order that the results may be readily interpreted. (MF 4.6.1).

Section 6 - **END-PRODUCT SPECIFICATIONS**

6.1 Appropriate methods should be used for sampling and examination to determine the compliance with the following specifications:

A. Shark products intended for human consumption should be free from micro-organisms in amounts harmful to man, free from parasites harmful to man and should not contain any substances originating from micro-organisms in amounts which may represent a hazard to health.

B. Shark products intended for human consumption should be free from chemical contaminants in amounts which may represent a hazard to health.

C. Shark products intended for human consumption should be, to the extent possible in good manufacturing practice, free from objectionable matter and also parasites harmful to humans.

D. Shark products intended for human consumption should comply with any requirements set forth by the Codex Alimentarius Commission on pesticide residues and food additives as contained in Codex lists of maximum limits for pesticides residues or Codex Commodity Standards, or should comply with the requirements on pesticide residues and food additives of the country in which the shark will be sold.